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371. ON TWO SPECIES OF *POLYMESODA* FROM THE TETORI GROUP IN THE HIDA MOUNTAINLAND, CENTRAL JAPAN

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飛騨山地の手取層群産 *Polymesoda* 2 種：岐阜県上宝村栃尾地域から産出した当 2 種はこれまで手取層群から報告されたことのないもので，これを記載し，併せて古地理上の意義と栃尾地域の手取層群の地質時代について論及した。2 種の中 1 種は新種で，*kobayashii* と命名した。

前 田 四 郎

It has already been reported by T. KAMEI and S. OHOTA (1949) that the Tetori group of the Kamitakara district, Hida mountainland, Gifu Pref., central Japan, contains a non-marine molluscan fauna with some plants. In 1957 the writer collected newly such fossils as *Polymesoda* (*Paracorbicula*) *sanchuensis* (YABE and NAGAO), *P.* (*Isodomella*) *kobayashii* MAEDA n. sp., "*Melanoides*" sp., "*Pila*" sp. and so forth.

The stratigraphical succession of the Tetori group in the central part of the Hida mountainland is tabulated below:

Akaiwa subgroup	Tochio alternation of sandstone and shale (about 600 m. thick)
Itoshiro subgroup	Taie alternation of sandstone and shale (200-500 m. thick)
Kuzuryu subgroup	Sugizaki sandstone (150-200 m. thick)
	Numamachi alternation of sandstone and shale (150-350 m. thick)
	Tanemura conglomerate (250-500 m. thick)

In the Kamitakara district the group developed along the upper reaches of the Takahara River consists only of the Tochio alternation, being inserted by faults into the metamorphic and nōn-metamorphic Palaeozoic basement complexes.

Received Nov. 27, 1958; read April 28, 1958.

The Tochio alternation is provided with a remarkable reddish or greenish tuffaceous rock facies as is widely known from the Cretaceous deposits in and around Japan. Moreover, the fauna now discovered resembles closely to those of the Ryoseki and Yoshimo formations which are ascertained to be Eo-Cretaceous in age. Judging from these facts, it may be better to assign the alternation to the Eo-Cretaceous rather than to the upper Jurassic as generally considered. From the palaeogeographical point of view, the discovery of the Ryoseki element from the Hida mountainland is extraordinarily important, because the so-called Ryoseki fauna was hitherto unknown from the inner zone of southwest Japan except the Yoshimo area in Yamaguchi Pref.

Among the non-marine shells obtained from the Tochio formation the two forms of *Polymesoda* which are specifically determined will be described in the following pages.

Before going to describe, however, the writer desires to acknowledge his indebtedness to Prof. T. KOBAYASHI of University of Tokyo and Dr. K. SUZUKI of the Research Institute for Natural Resources for their constant guidance in the course of this study. He is also

indebted to Mr. T. HAMADA, a postgraduate student of University of Tokyo, for his kind advice in the field survey.

Description of Species

Family Corbiculidae

Genus *Polymesoda* RAFINESQUE, 1820

Subgenus *Isodomella* KOBAYASHI and SUZUKI, 1939

Polymesoda (*Isodomella*) *kobayashii* MAEDA, n. sp.

Plate 17, Figures 1-11.

Description:—Shell large in size, triangular in outline, somewhat longer than high, inequilateral, moderately short and well round in front, obliquely produced behind, fairly inflated but more or less impressed in the median portion of the disc; test thick. Postero-dorsal margin scarcely curved near the beak, fairly long, straightly sloping into the posterior; posterior margin very short, rapidly bent forward into the ventral at an acute angle; ventral margin fairly long, arched, gradually going over into the well rounded anterior; antero-dorsal margin concave, gently arcuated. Umbo comparatively large, located at a point about one-fourth across from the anterior extremity, incurved and directed forward, somewhat elevated above the hinge-margin. Posterior ridge prominent; posterior area impressed, lanceolate. Surface ornamented with concentric growth lines and sometimes with slightly elevated wrinkles. Hinge-plate rather large; cardinal teeth three on each valve, middle and anterior cardinal teeth strong; lateral teeth two, smooth; posterior one slightly curved inward, long, lameller, parallel with the postero-dorsal margin; anterior short.

Adductor scars situated close to the extremities of the laterals and faintly impressed. Pallial line simple. Inner side of the shell smooth.

Measurements:—4 type specimens scarcely deformed measure in mm as listed below

Number	Length	Height	Width
1 (Left, holotype)	60	44	10×2
2 (Right)	60	46	10×2
3 (Left)	45	37	7×2
4 (Left)	34	30	5×2

Locality and formation:—The bed of the Kashiwate River, a tributary of the Takahara River, in Kamitakara-mura, Yoshiki-gun, Gifu Pref.; Tochio alternation of sandstone and shale in the Akaiwa subgroup, the upper division of the Tetori group.

Remarks:—The specimens at hand resemble the figures of *Polymesoda* (*Isodomella*) *shiroiensis* (YABE and NAGAO) given by H. YABE, T. NAGAO and S. SHIMIZU in 1926 from the Cretaceous deposits in the Sanchu graben of the Kwanto massif, central Japan, and by T. KOBAYASHI and K. SUZUKI in 1939 from the Eo-Cretaceous Yoshimo formation in the inner zone of southwest Japan, but they are easily distinguishable therefrom by having the beak situated more anteriorly and by being much larger in size.

This species is also related to *P.* (*I.*) *naumanii* (NEUMAYR) figured by E. NAUMANN and M. NEUMAYR in 1890 and by H. YABE, T. NAGAO and S. SHIMIZU in 1926, but they differ from each other in features of the posterior ridge and outline of the shell. Though *P.* (*I.*) *kueichouensis* (GRABAU) described in 1923 by A. W. GRABAU from the Cretaceous

deposits of China shows some resemblances to this new species in general characters, the two species do not coincide in ratio of height to length.

The specific name is dedicated to Prof. Teiichi KOBAYASHI who kindly adviced the writer through the study of the historical geology of the Jurasso-Cretaceous Tetori group.

Subgenus *Paracorbicula* KOBAYASHI and SUZUKI, 1939

Polymesoda (*Paracorbicula*) *sanchuensis* (YABE and NAGAO)

Plate 17, Figures 12-16.

1926. *Corbicula* (*Veloritina ?*) *sanchuensis* YABE and NAGAO, *Sci. Rep., Tohoku Imp. Univ., 2d Ser., Vol. 9*, pp. 53-54, pl. 12, figs. 8, 8a, pl. 13, figs. 8-10, 17, 17a.
1939. *Corbicula sanchuensis*, KOBAYASHI and SUZUKI, *Japan. Jour. Geol. Geogr., Vol. 16, Nos. 3-4*, pp. 221-222, pl. 14, figs. 10-15.
1949. *Polymesoda* (*Paracorbicula*) *sanchuensis*, SUZUKI, *Japan. Jour. Geol. Geogr., Vol. 21, Nos. 1-4*, p. 119.
1955. *Polymesoda* (*Paracorbicula*) cf. *sanchuensis*, YAMAGIWA, *Mem. Osaka Univ., Liberal Arts and Educ., No. 3.*

Description:—Shell medium in size, subcircular in outline, nearly as high as long, inequilateral, well rounded in front, fairly long and well rounded behind, with the maximum convexity located close to the umbo; test thick. Postero-dorsal margin more or less straight, sloping into the posterior without making any angle; posterior margin fairly long, feebly truncated, bent forward with an obtuse angle; ventral margin long, very broadly arched, gradually going over into the anterior margin, which is gently curved; antero-dorsal margin well rounded. Umbo large, located anteriorly, slightly inflated, incurved, directed forward, somewhat projected above the hinge-margin. Surface ornamented with concentric growth lines. Hinge well developed; cardinal teeth three on each valve, two of them usually strong; lateral teeth curved, crenated; posterior one longer than the anterior. Adductor scar lanceolated ovate; posterior one subovate in outline, distinctly impressed especially on its inner margin; posterior one broader than the anterior. Pallial line deeply sinuated. Inner side of the shell smooth.

Measurements:—More or less broken two specimens selected from the collection measure in mm. as follows:

Number	Length	Height	Width
1 (Left)	31	32	10×2
2 (Right)	16	—	4×2

Locality and formation:—The bed of the Kashiwate River, a tributary of the Takahara River, Gifu Pref.: Tochio alternation of sandstone and shale.

Remarks:—Several imperfect specimens were found in the collection. With regard to the covexity and outline of this species, T. KOBAYASHI and K. SUZUKI (1939) had stated that minor points of these features are not the same in every specimens, though the change from one to another is gradual.

The specimens at hand resemble most closely to YABE and NAGAO's form illustrated in fig. 8 on Pl. 12 of their report, but they slightly differ from the form shown by YABE and NAGAO as fig. 9 on Pl. 13 in outline of the shell. The present specimens are also allied to KOBAYASHI and SUZUKI's specimens, but the former are generally thicker than the latter in width. Nevertheless, none of these minor differences seems to have a value for specific distinction.

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YAMAGIWA, N. (1955), Cretaceous Mollusca from the Shima Peninsula, Japan. *Mem. Osaka Univ., Liberal Arts and Educ., No. 3.*

Explanation of Plate 17

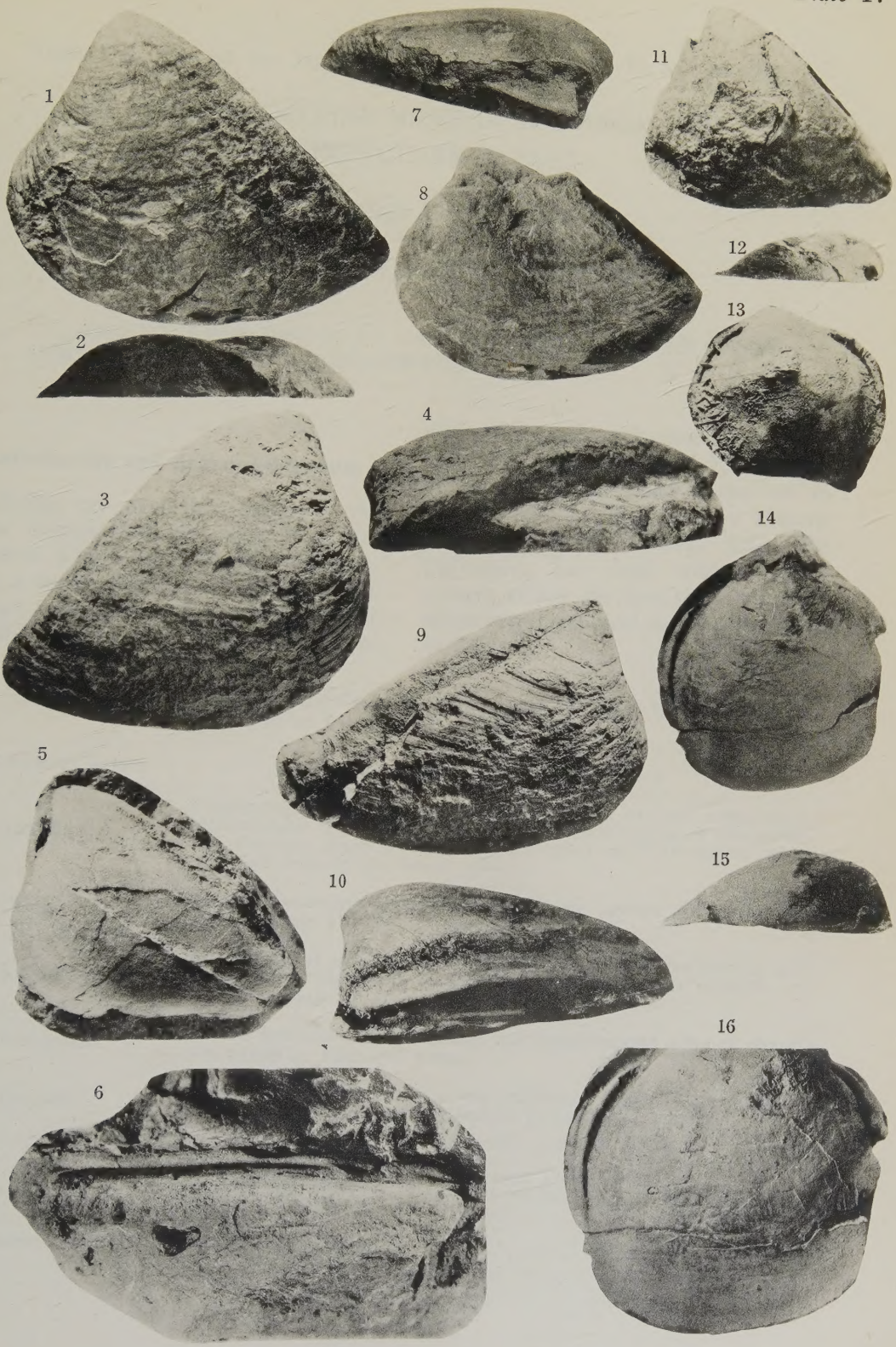
All the illustrated specimens are kept in the Institute of Geology, College of Arts and Sciences, Chiba University, Chiba, (Loc: Tochio alternation of sandstone and shale in the Akaiwa subgroup, the upper division of the Tetori group, developed in Kamitakara-mura, Yoshiki-gun, Gifu Pref.)

Polymesoda (*Isodomella*) *kobayashii* MAEDA, new species.

Fig. 1. Left valve, holotype. ×1.0.
Fig. 2. Umbonal view of holotype. ×1.0.
Fig. 3. Right valve, paratype. ×1.0.
Fig. 4. Lateral view of the specimen shown in Fig. 3. ×1.0.
Fig. 5. Internal mould of left valve, paratype. ×0.9.
Fig. 6. Character of lateral teeth of a paratype. ×1.5.
Fig. 7. Umbonal view of the specimen shown in Fig. 8. ×1.0.
Fig. 8. Left valve, paratype. ×1.0.
Fig. 9. Right valve, paratype. ×1.0.
Fig. 10. Lateral view of the specimen shown in Fig. 9. ×1.0.
Fig. 11. Left valve, paratype. ×1.0.

Polymesoda (*Paracorbicula*) *sanchuensis* (YABE and NAGAO)

Fig. 12. Lateral view of the specimen shown in Fig. 13. ×1.6.
Fig. 13. Internal mould of left valve. ×2.0.
Fig. 14. Internal mould of right valve. ×1.2.
Fig. 15. Lateral view of the specimen shown in Fig. 14. ×1.2.
Fig. 16. Character of sinus. ×1.6.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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 36, pp. 161-167, pl. 18, Nov. 30, 1959

372. ON SOME MARINE MIOCENE MOLLUSCA FROM MIE PREFECTURE, JAPAN*

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三重県の海成中新統軟体動物について：一志層群の軟体動物について，5新種・2新亜種を記載し，且つ同層群の時代について若干の考察を行つた。　荒木慶雄

Introduction and Acknowledgements

During my geological studies in the area surrounding Tsu City, Mie Prefecture, I have been fortunate in obtaining a large collection of fossil molluscs, some foraminifers and others. Some molluscs among of them being considered to represent undescribed forms will be treated in this article. All of the fossils are now preserved in the collection of the Geology Department, Faculty of Liberal Arts, Mie University, and those treated in the present article are from the Isshi group, whose stratigraphical sequence is shown in Table 1.

Table 1. Stratigraphical sequence of the Isshi group developed in the area west of Tsu City, Mie Prefecture

Formation names	General lithological characteristics
Yakuôji	Alternation of sandstone and siltstone (more or less tuffaceous) intercalating thin tuff in the upper part, alternation of sandstone and siltstone (more or less of flysch type) and 5-10 meters thick black siltstone in the lower part.
Chaya	Massive sandstone intercalating siltstone layers, alternation of sandstone and siltstone at places.
Kaisekizan	Alternation of sandstone and tuffaceous siltstone intercalating tuff in the upper part, dark muddy sandstone with sandy siltstone in the lower part.
Furutaike	Arkoze sandstone intercalating thin conglomerate beds of gneiss and granite. Thin coal seam.
Kongôbô	Alternation of conglomerate and sandstone, cobble to boulder size conglomerate of gneiss and granite in sandstone matrix.
	unconformity and fault
	Pre-Tertiary basement of gneiss and granite.

* Received Dec. 15, 1958; read June 6, 1958.

Unfortunately there are no descriptive works on the fossil marine mollusca from the Isshi group in Mie Prefecture but K. TAKIMOTO (1935) listed the molluscan fossils from the group and J. YAMADA (1958) reported the molluscan fossils from the Kaisekizan formation in the southern part of the same group. Therefore, although a full account of the fossil marine molluscs will be given at another opportunity, it is thought that the descriptions of some of the species considered to be new to science will faciliate the studies of other molluscan paleontologists in Japan and also serve to suggest the kind of fauna occurring from the Miocene deposits in the area west of Ise Bay, Mie Prefecture.

The molluscan fauna from the Miocene series (Isshi group) developed in the area west of Tsu City comprise a typical warm water assemblage, a characteristic feature of the early Miocene marine fauna of Japan. This kind of fauna is widespread, being known from Hokkaidô in the north, from where it ranges southwards to the tip of the main island of Japan. Everywhere throughout this area, the early Miocene molluscan fauna contains warm water species, although it is evident that the number of typically subtropical or warm temperate forms decrease with the increase in latitude, and vice versa.

The Miocene series as represented in the present area is thought to include only the early Miocene in a two-fold division of the series. It may be correlated with deposits in other areas containing such molluscs as *Glycymeris cisshuensis* MAKIYAMA, *Gl. idensis* KANNO, *Lima yagenensis* OTUKA, *Periploma yokoyamai* MAKIYAMA, *Joanisiella meisensis* MAKIYAMA, *Dosinia chikuzenensis* NAGAO, *Soletellina minoensis* YOKOYAMA, *Turritella s-hataii* NOMURA, besides others, which also occur in the present area.

Here I wish to thank Professor Kotora HATAI of the Department of Geology, Faculty of Education, Tohoku University, for his kind advice concerning the present work. I also thank Professors Shôshiro HANZAWA and Kiyoshi ASANO of the Institute of Geology and Paleontology, Tohoku University, for their kindness during my research in that Institute.

Descriptions of the New Species

Family Mytilidae

Genus *Musculus* RÖDING, 1798

Musculus hataii ARAKI, n. sp.

Plate 18, Figure 1.

Description:—Shell rather large, measuring about 40 mm in length, 25 mm in height and about 10 mm in depth of a right valve. Elongate-subquadrate in outline, dorsal and ventral borders nearly parallel with one another; anterior and posterior sides rounded, the anoterior more narrowly than the posterior, rather inflated with thin shell, obscurely provided with fine radial threads or striae on posterior and anterior sides of shell, the whole with fine concentric growth lines. Beak swollen, inturned, directed forwards; obscure but wide depressed area extending from behind beak to middle to posterior part of ventral margin.

Remarks:—This new species resembles *Musculus laevigatus* (GRAY) figured by T. HABE (1955, pl. 4, figs. 12, 13) from Hokkaido, but can be distinguished therefrom by the more prominent beak, less flaring posterior side of the shell, more equally parallel dorsal and ventral margins, and by the less distinct radial striae.

Locality and geological formation:—Roadside cliff at about 300 meters northwest of Onohira, Geinô-chô, Age-gun, Mie Prefecture. Kaisekizan formation, Miocene.

Depository:—Geology Department, Mie University.

Family Periplomatidae

Genus *Periploma* Schumacher, 1817

Periploma mitsuganoense
Araki, n. sp.

Plate 18, Figures 2a, 2b.

Description:—Shell moderate in size, rather long, more or less rounded, subquadrate in outline, inequivalve, the right deeper and better preserved than the left; anterior and posterior borders rounded, the latter more broadly than the former; ventral border broadly rounded, rather sharply passing into anterior one but gradually into the posterior; beaks small, pointed, directed anteriorly, umbonal region slightly swollen; anterior dorsal border narrowly rounded angulation; surface provided with periodic undulating and interstitial finer concentric growth lines, of which those of the latter are obscure; ill-defined blunt ridge extending from in front of beak towards antero-ventral corner, becoming obscure near mid-region. Length about 43 mm, height about 34 mm, depth of intact valves about 10.5 mm.

Remarks:—This species has been compared with *Periploma besshoense* (Yokoyama) (Yokoyama, 1924), *P. yokoyamai* Makiyama (Makiyama, 1934), *P. pulchellum* Hatai and Nisiyama (Hatai and Nisiyama, 1949), *P. ovata* Kuroda and Horikoshi (Kuroda and Horikoshi, 1952), and *P. otohimeae* Habe (Habe, 1952), and was found to differ from each of the mentioned ones by the size of the shell, outline, angularity of the anterior half of the shell, and by the growth lines being periodically undulating and having obscure interstitial ones.

Besides the holotype specimen there are several paratypes, but the majority are more or less fractured or deformed, but still retain the specific characters above described.

Locality and geological formation:—Tsuzumi Pass, Mitsugano, Hakusan-chô, Isshi-gun, Mie Prefecture (Holotype and Paratypes). Cliff of the southern slope of Kaisekizan, Sakakihara, Hisai-chô, Isshi-gun, Mie Prefecture (Paratypes). Both of the Kaisekizan formation. Miocene.

Depository:—Geology Department, Mie University.

Family Carditidae

Genus *Venericardia* Lamarck, 1801

Venericardia funayamensis
Araki, n. sp.

Plate 18, Figure 3.

Description:—Shell rather large, measuring 45.5 mm in length, 42 mm in height and about 16 mm in depth of a right valve. Subquadrate in outline, longer than high, moderately convex; beak small, pointed, directed forward, umbonal region not much swollen; postero-dorsal border long, rather straight, and forming with broadly rounded ventral border a rather sharp but rounded angulation; antero-dorsal side rounded, gradually merging into ventral border with large angulation. Surface with about 22 radial ribs, which are much broader than their narrow valley-like interspaces; radial ribs broadly

rounded, sharply descending into narrow v-shaped interspaces, crossed with concentric growth lines; eroded shell surface with radial ribs as squarely rounded elevations about equal to or a little narrower than their flat-bottomed interspaces. Hinge-teeth and other internal features inaccessible.

Remarks:—This new species is easily distinguished from *Venericardia siogamensis* NOMURA (1935, pl. 17, figs. 8-11), a Miocene species originally described from Siogama City, Miyagi Prefecture, by the shape of the shell which is more trigonal; the number and type of radial ribs in the two species are about the same, but the size and shape of the shell are quite different.

Locality and geological formation:—Road cutting on road leading from Funayama to Kôzahara, Misato-mura, Age-gun, Mie Prefecture. Kaisekizan formation. Miocene.

Depository:—Geology Department, Mie University.

Family Veneridae

Genus *Cyclina* DESHAYES, 1849

Cyclina kamadae ARAKI, n. sp.

Plate 18, Figures 4a, 4b.

Description:—Shell large in size, a little longer than high, subcircular. Antero-dorsal border broadly expanded, the postero-dorsal roundly sloping into posterior side which is well rounded. Anterior side rounded, well expanded. Ventral margin rather sharply rounded with fine crenulations on its inner border. Shell rather thin, provided with fine concentric growth lines and periodic coarse ones. Beak small, pointed, incurved, directed anteriorly. Sinus and muscular impressions obscured. Height 50.5 mm, length about 53.5 mm, depth of a right valve about 15 mm.

Remarks:—This new species resembles *Cyclina* (*Cyclinorbis*) *lunulata* MAKIYAMA (1926, pl. 13, fig. 1) from the Miocene of North Korea, but may be distinguished therefrom by the more expanded anterior side, weaker concentric sculpture, more arched antero-dorsal border and less straight posterior border. *Cyclina japonica* KAMADA (1952, pl. 15, figs. 1a-b, 2, 4) from the Miocene of Gifu Prefecture, differs from the present one by the shape of the shell.

The specific name is given in honor of Mr. Yasuhiko KAMADA of the Nagasaki University, who had particular interest in the species of the genus *Cyclina*.

Locality and geological formation:—Small cliff at the paddy-field situated at about 200 meters northwest of Bessho, Misato-mura, Age-gun, Mie Prefecture. Furutaike sandstone. Miocene.

Depository:—Geology Department, Mie University.

Family Dentaliidae

Genus *Dentalium* LINNÉ, 1758

Dentalium misatoensis ARAKI, n. sp.

Plate 18, Figures 5a, 5b.

Description:—Shell generally large, measuring more than 75 mm in length and exceeding 9 mm in diameter, test heavy. Shell nearly straight, only slightly curved, gently tapering. Apertural and apical extremities broken. Smooth throughout, only with weak concentric growth rings. Shell of under surface with undulating rings.

Remarks:—This species more or less resembles *Dentalium weinkauffi* DUNKER figured by HIRASE (1932, pl. 3, fig.), a

common Recent shell of Japan and also occurring as fossil from the Pliocene to younger deposits of Japan. However, in DUNKER's species there are longitudinal striae at the apical part, whereas they are not developed in the present new species, and the shell of the present specimens is thicher.

This is a common species in the present area where it occurs in association with many other molluscs of the genera *Venericardia*, *Turritella*, *Euspira* and encrusting calcareous algae.

Locality and geological formation:—Road cutting on road leading from Funayama to Kôzahara, Funayama, Misato-mura, Age-gun, Mie Prefecture (Holotype). Roadside cliff at the western side of Nakamura, Hisai-chô, Isshi-gun, Mie Prefecture. Both of the Kaisekizan formation. Miocene.

Depository:—Geology Department, Mie University.

Family Volutidae

Genus *Fulgoraria* SCHUMACHER, 1817

Fulgoraria hirasei yanagidaniensis
ARAKI, n. subsp.

Plate 18, Figure 6.

Description:—The present subspecies resembles *Fulgoraria hirasei* SOWERBY figured by SMITH (1942, pl. 10, fig. 78) in general features, but can be distinguished therefrom by the narrower shell, more twisted canal, more narrowly spaced longitudinal ridges which extend nearly over the body whorl as mere striations, and by the concentric striae being apparently stronger. The curvature of the shoulder is more expanded. Height about 71 mm, maximum diameter of body whorl about 18 mm.

Remarks:—Unfortunately the features of the aperture remain unknown owing to the covering of the matrix and also the youngest whorls could not be extracted from the matrix.

Locality and geological formation:—Small cliff near the temple of Yanagidani, Misato-mura, Age-gun, Mie Prefecture (Holotype). Kaisekizan formation. 200 meters north of Kubo on road leading from Kubo to Shibukuro in the western part of Tsu City, Mie Prefecture. Yakuôji formation. Both Miocene.

Depository:—Geology Department, Mie University.

Family Neptuneidae

Genus *Ancistrolepis* DALL, 1894

Ancistrolepis trochoideus miensis
ARAKI, n. subsp.

Plate 18, Figures 7a, 7b, 8.

Description:—This new subspecies resembles *Ancistrolepis trochoideus* DALL (1921, pl. 9, fig. 5; SUZUKI, 1935) in general shape of the shell and in the possession of spiral cords which are much narrower than their interspaces and which often contain one or two intercalary threads. However, the present one differs from DALL's species in having eight spiral cords on the body whorl, three in the adult on the penultimate and in young specimens only two on the penultimate and one on the second whorls. The whorls are less shouldered, more rounded, and the spiral cords rarely accompany with intercalary threads. Height 40 and 22mm, maximum diameters of body whorl 26 and 16 mm respectively for two specimens (Cotype).

Remarks:—*Neptunea omurai* OTUKA (1940, pl. 11, figs. 5, 6) from the Miocene

deposits in Teshio Province, Hokkaido, more or less resembles the present subspecies, but can be distinguished from it by the narrower and higher shell, less recurved canal, and by the number and strength of both spiral cords and intercalary threads.

Locality and geological formation:—200 meters north of Kubo on road leading from Kubo to Shibukuro in the western part of Tsu City, Mie Prefecture. Yakuôji formation. Cliff of the southern slope of Kaisekizan, Sakakihara, Hisai-chô, Isshi-gun, Mie Prefecture. Kaisekizan formation. Both Miocene.

Depository:—Geology Department, Mie University.

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Explanation of Plate 18

(All figures in natural size)

Fig. 1. *Musculus hataii* ARAKI, n. sp. Holotype. Loc.: Roadside cliff at about 300 meters northwest of Onohira, Geinô-chô, Age-gun, Mie Prefecture. Kaisekizan formation.

Figs. 2a, 2b. *Periploma mitsuganoense* ARAKI, n. sp. Holotype. Loc.: Tsuzumi Pass, Mitsugano, Hakusan-chô, Isshi-gun, Mie Prefecture. Kaisekizan formation. 2a, view of the right valve. 2b, view from the dorsal border.

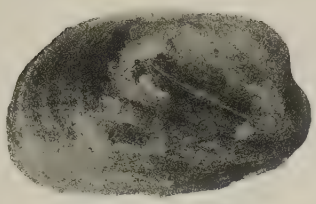
Fig. 3. *Venericardia funayamensis* ARAKI, n. sp. Holotype. View of the right valve. Loc.: Road cutting on road leading from Funayama to Kôzahara, Misato-mura, Age-gun, Mie Prefecture. Kaisekizan formation.

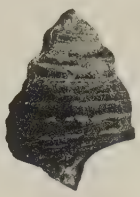
Figs. 4a, 4b. *Cyclina kamadae* ARAKI, n. sp. Holotype. 4a, view of right valve. 4b, view of the same from the beak. Loc.: Small cliff at the paddy-field situated at about 200 meters northwest of Bessho, Misato-mura, Age-gun, Mie Prefecture. Furutaike sandstone.

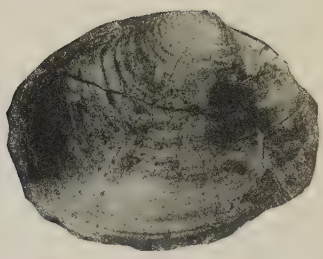
Figs. 5a, 5b. *Dentalium misatoensis* ARAKI, n. sp. Holotype. 5a, lateral view. 5b, cross section of the aperture. Loc.: Road cutting on road leading from Funayama to Kozahara, Misato-mura, Age-gun, Mie Prefecture. Kaisekizan formation.

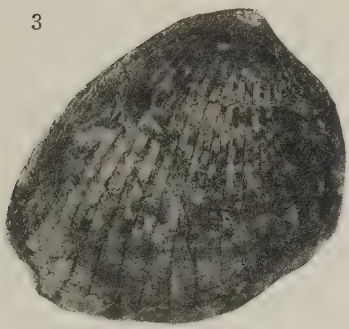
Fig. 6. *Fulgoraria hirasei yanagidaniensis* ARAKI, n. subsp. Holotype. Although the apical part is not fully exposed, the characters are of subspecific value. Loc.: Small cliff near the temple of Yanagidani, Misato-mura, Age-gun, Mie Prefecture. Kaisekizan formation.

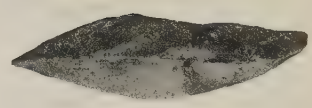
Figs. 7a, 7b, 8. *Ancistrolepis trochoideus miensis* ARAKI, n. subsp. Cotype. 7a, back view of 7b, which is the front view. 8, fractured specimen showing the features of the younger whorls. Loc.: Cliff of the southern slope of Kaisekizan, Sakakihara, Hisai-cho, Isshi-gun, Mie Prefecture. Kaisekizan formation.

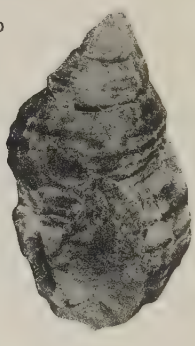


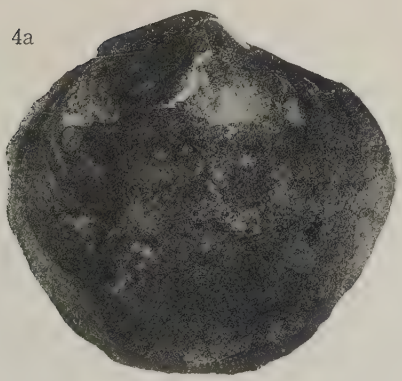


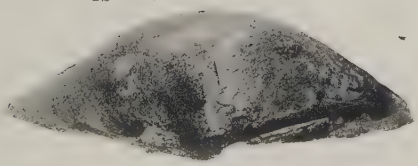












KUMAGAI Photo.

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373. TAXODONTA AND ISODONTA FROM THE JURASSIC SOMA GROUP IN NORTH JAPAN*

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福島県相馬の上部ジユラ紀層群産二枚貝化石：相馬ジユラ紀層群産二枚貝化石のうち，鳥巣動物群に入れられる中の沢及び小山田の各層の Taxodonta (6 種，うち 2 新種) 及び Isodonta (15 種，うち 3 新種) を記載した。これらの二枚貝化石は四国佐川地方及び九州の坂本附近の鳥巣統産のものと酷似しており，これら 3 地域の動物群の親近性を示している。

又北西欧及びヒマラヤ・エチオピヤ区の上部ジユラ系から産する *Ctenostreon proboscideum* (J. Sow.) が産出する。

田　村　実

It has long been known that the Koike limestone in Soma district, Fukushima Prefecture (Province of Iwaki) is a member of the Jurassic Torinosu limestone widely distributed along the Pacific side of Japan. It was referred to Kimmeridgian by Kobayashi (1935) by *Aulacosphinctoides* aff. *steigeri*. According to Masatani (1950) the Soma Jurassic which forms an anticlinolium consists of the following formations in descending order:

Koyamada formation
——— conformity
Tomizawa formation
——— conformity
Nakanosawa formation
——— conformity
Tochikubo formation
——— fault (probably unconformity)
Sugaya formation
——— disconformity
Awazu formation
——— unconformity
Hayama formation

Giving fossil lists by provisional determination, Masatani suggests Bathonian or Callovian, Oxfordian or Kimmeridgian and Portlandian respectively for the Awazu, Nakanosawa and Koyamada formations. Subsequently Kimura (1954) studied the sedimentary rocks of the Nakanosawa formation with the result it was found that the Koike limestone is not a single bed but an aggregate of limestone lenses with marly and sandy intercalations.

Because the group contains several fossil beds and its structure is relatively simple, it bears special importance for the Upper Jurassic stratigraphy in the Pacific side of Japan. Under the guidance of Prof. T. Kobayashi, the writer has studied the group and discovered 10 zones of Trigoniae (Fig. 2), as already described by T. Kobayashi and the writer (1956, 1957). Judging from the Trigoniae, the Soma Jurassic can be divided into two major parts, namely, the upper or the Koyamada-Nakanosawa formations and the lower or Sugaya-Awazu formations. In the upper, *Myophorella*, especially *Haidaia*, is the leading members. *Haidaia*, in

* Received Jan. 17, 1959; read Feb. 14, 1959.

particular, is restricted to this part and its equivalents in West Japan. On the other hand, the lower Trigonian assemblage characterized by *Scaphotrigonia*, *Latitrigonia* and *Ibotrigonia* is similar to the Aratozaki assemblage and the lower Tetori assemblage. *Nipponitrigonia sagawai*, however, occurs from the lower as well as the upper part. Its occurrence is also reported from the Torinosu and Tetori groups. No pelecypod species is common between the Sugaya and Nakanosawa formations, although there are some co-existent genera.

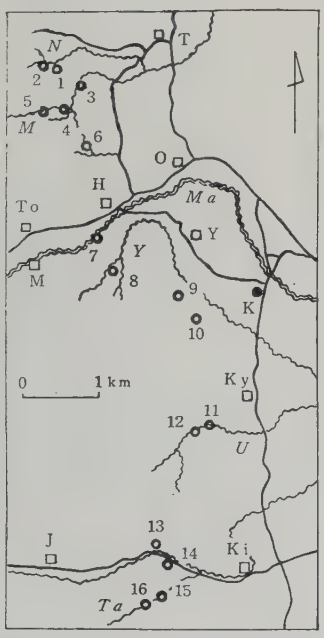

Fig. 1. Fossil localities of Koyamada and Nakanosawa formations.

H: Hayama	Y: Yamashita
J: Jisahara	*M:* Minamisawa
K: Kurumagawa	*Ma:* Mano river
Ki: Koike	*N:* Nakanosawa
Ky: Koyamada	*Ta:* Tatenosawa
M: Minahara	*U:* Umasawa
O: Oyama	*Y:* Yasukirasawa
T: Tomizawa	1-16: see Table 1.
To: Tochikubo	

The present study is dealt with the pelecypods from the Nakanosawa and Koyamada formations.

Beside the Trigoniae *Neoburmesia iwakiensis* was described by Yabe and Sato (1942) and *Somapecten kamimanensis* and *Aequipecten ogawensis* by Kimura (1951). Here the Taxodonta and Isodonta are described. The stratigraphic notes, fossil zones and localities are summarized and shown in figures 1-4 and table 1. The fossils, here used, were collected by Masatani, Kimura and others including the writer and stored in the Geological Institute, University of Tokyo. The writer wishes to express his cordial thanks to Prof. T. Kobayashi of the University of Tokyo for constant guidance, supervision of the manuscript and permission for describing the fossils in his institute. Thanks are also due to Assist. Prof. T. Kimura, Messrs I. Hayami and A. Tokuyama of the same university for their assistances.

Family Parallelodontidae

Genus *Parallelodon* Meek and Worthen, 1866

Parallelodon koikensis Tamura, new species

Plate 19, Figures 9-11.

Description:—Shell small, moderately inflated, much inequilateral, elongate and rectangular in outline, about twice as long as high; umbo slightly incurved, at about 1/3 from anterior end; dorsal margin subparallel to ventral; umbonal furrow shallow but causing a sinuation on ventral margin; umbonal carina distinct; post-carinal area strongly depressed; radial ribs numerous, fine but strengthened on lateral sides, especially so about post carinal 8.

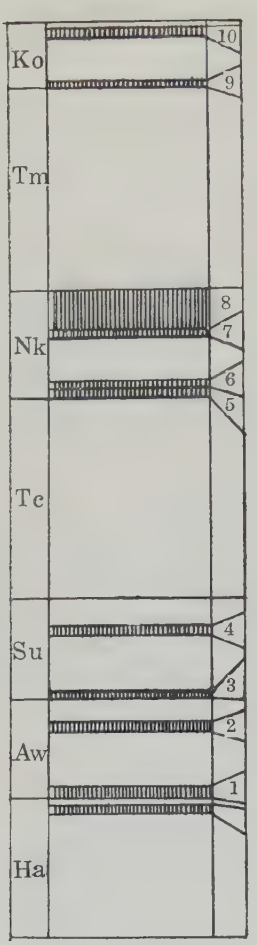

Fig. 2. Pelecypod's fossil zones in Soma Jurassic group (×1/1250)

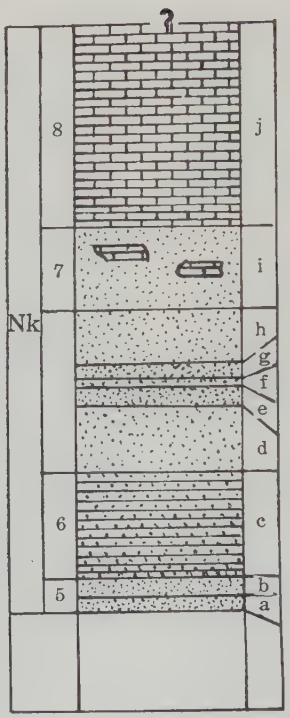

Fig. 3. Nakanosawa formation at Nakanosawa (×1/125)

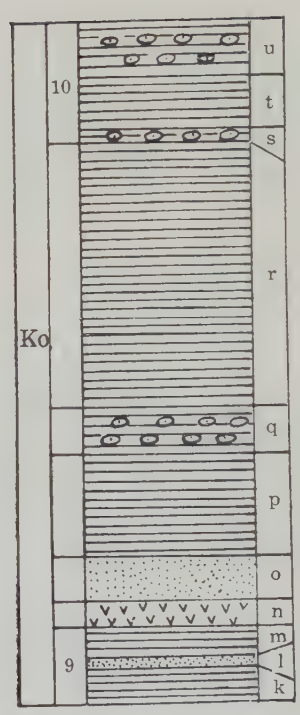

Fig. 4. Koyamada formation at Umasawa (×1/125)

Aw: Awazu formation
Ha: Hayama formation
Ko: Koyamada formation
Na: Nakanosawa formation
Su: Sugaya formation
Tc: Tochikubo formation
Tm: Tomizawa formation
1 10: Trigonian zones
a: coarse ss
b: *Lima* rich ss
c: platy ss
d, e, g, h: coarse quartzose ss
f: calcareous ss
i: calcareous ls bearing ss
j: Koike ls, bearing sandy & marly part
k, m, p, r, t: black sh partly sandy sh
l, o: coarse ss
q, s, u: black sh, partly sandy ss and rich in onion structure

Table 1. Fossil locality and its horizon

No. of Fossil locality in Fig. 1	No. of Trigonian zones in Fig. 3	Fossil locality
1	6	Nakanosawa, Tomizawa, Soma city
2	5	〃
3	7	Minamisawa, Tomizawa, Soma city
4	7	〃
5	5 & 6	〃
6	8	North valley of Hayama, Kamimano-village, Soma co.
7	7	East of Minahara, Kamimano-village, Soma co.
8	5	West of Yamashita (Yasukurasawa), Kamimano-village.
9	10	South of Yamashita, Kamimano-village.
10	10	West of Kurumagawa, Kamimano-village.
11	10	Umasawa, Koyamada, Kamimano-village.
12	9	〃
13	8	Koike, Kamimano-village.
14	8	〃
15	7 & 8	Tatenosawa, Koike, Kamimano-village.
16	6	〃

Table 2. Fossil species and its range chart

Fossil species	Fossil Zone					
	5	6	7	8	9	10
Parallelodon koikensis TAMURA, n. sp.			×	×		
Parallelodon aff. *inflatus* TAMURA					×	
Grammatodon takiensis KIMURA	×		×	×	×	×
Grammatodon (*Indogrammatodon*) *densistriatus* TAMURA, n. sp.	×					
Catella (*Torinosucatella*) *kobayashii* TAMURA			×	×		
Nuculana (*Dacryomya*) *stenodolichos* KIMURA				×		
Chlamys camptonectoides TAMURA, n. sp.			×	×		
Chlamys sp.	×					
Chlamys (*Radulopecten*) *ogawensis* (KIMURA)	×	×		×		
Camptonectes sp.	×					
"*Aequipecten*" *vulgaris* KIMURA	×					
"*Aequipecten*" *kotsubu* KIMURA	×					
Eopecten punctus (KIMURA)	×		×			
Entolium yatsujiense KURATA and KIMURA		×				
Entolium kimurai TAMURA						×
Somapecten kamimanensis KIMURA	×	×				
Lima (*Ctenoides*) *tosana* KIMURA	×					
Lima (*Plagiostoma*) *enormicosta* TAMURA, n. sp.	×					
Lima (*Plagiostoma*) sp.	×					
Ctenostreon proboscideum (J. SOWERBY)	×					
Plicatula dichotomocosta TAMURA, n. sp.	×					

Measurements:—	L	H
Holotype (left valve: MM3193)	21 mm	10 mm
Paratype (left valve: MM3195)	20	10

Observation:—Two left valves and an incomplete right valve at hand are black, probably stained by carbonaceous matter which is rich in the Koike limestone. The furrow on surface is shallow but distinct in the paratype specimen (MM3195). The elongate shape and fairly coarse ribs on the depressed post-carinal part are the characteristic of the species. It is a non-alate *Parallelodon*.

Comparison:—This can be easily distinguished from *P. inflatus* TAMURA (1959) in its small size, anterior umbo and elongate outline. *P. niranohamensis* HAYAMI (1958) from the Liassic Niranohama formation is quite different from it in the post-carinal ornaments. *Arca quadrisulcata* SOW. (LORIOL et PELLET; 1875) from the Sequanian of Mont des Boulogne-sur-Mer is somewhat allied to it, but the post-carinal ribs are only 4. *Parallelodon keyserlingii* (d'ORBIGNY) from the Oxfordian of Cambridgeshire (ARKELL; 1929) resembles it but the post-carinal ribs are not so coarse.

Occurrence:—7th zone at Locs. 13, 15 and 8th zone at Loc. 14.

Parallelodon aff. *inflatus* TAMURA

Plate 19, Figures 12-15.

aff. 1959. *Parallelodon inflatus*, TAMURA, p. 53, pl. 6, figs 9, 10.

Description:—Shell medium to large, inflated, elongated and somewhat oblong in outline; umbo incurved, improminent; umbonal furrow shallow; ventral margin sinuate at the end of the furrow; umbonal angulation carina-like; surface with numerous radial ribs and concentric growth-lines; hinge of *Parallelodon* type.

Observation:—This description is founded on a incomplete internal mould and its external one. Its large and inflated form agrees probably *P. inflatus* from the Jurassic Sakamoto formation, though the furrow on surface is invisible in the Sakamoto form. The surface ornaments consist of numerous radial ribs in addition to a secondary rib in each interspace and many concentric lines. It looks like a net-work.

Occurrence:—9th zone at Loc. 12.

Family Cucullaeidae

Genus *Grammatodon* MEEK and HAYDEN, 1860

Grammatodon takiensis KIMURA

Plate 19, Figures 4-6.

1956. *Grammatodon takiensis*, KIMURA, p. 85, pl. 1, fig. 6.
1959. *Grammatodon takiensis*, TAMURA, p. 54, pl. 6, figs. 1, 2.

This species is variable in outline and ornaments but generally small. Radial ornaments are feeble or obsolete in the middle part. Anterior radial ribs are usually about 13 but posterior ones vary in number. In some, 3-4 secondary ribs are inserted but in others primary and secondary ribs are indistinguishable.

Occurrence:—5th zone at Locs. 7, 8; 7th zone at Locs. 13, 15; 8th zone at Loc. 14; 9th and 10th zones at Locs. 9, 10, 11, 12.

Subgenus *Indogrammatodon* Cox, 1937

Grammatodon (*Indogrammatodon*) *densistriatus* Tamura, new species

Plate 19, Figures 4-6.

Description:—Shell small for subgenus, moderately convex, equivalve, inequilateral, elongate and trapeziform in outline; umbo not strongly inflated, prosogyrate, slightly incurved and situate at about anterior 1/3 of hinge; hinge-line nearly straight; posterior margin obliquely extended back; anterior inseparable from rounded ventral margin; umbonal carina blunt; left valve ornamented by numerous radial ribs and several concentric growth-lines; radials coarser in anterior side and fine in postcarinal part; hinge of *Grammatodon*-type, i. e. 3 elongate teeth parallel to hinge margin in posterior part of right valve and 2 in left.

Measurements:—	L	H	H/L
Right valve (MM3201)	29 mm	18 mm	0. 62
Left (MM3202)	23	14	0. 61
Right (MM3203)	22	13	0. 59
Left (MM3203)	21	11	0. 52
Left (MM3204)	23	13	0. 57

Observation:—Several specimens showing external at hand are all moulds of left valves. The difference on surface ornaments between both valves is unknown, but its distinct radial ribs, not inflated umbo, elongated and obliquely extended form are the characteristics of *Indogrammatodon*. The radial ribs in the left valve are unusually fine and numerous for *Indogrammatodon*. Several concentric striae cross the radial ribs and look net-like in posterior.

Comparison:—This resembles *Grammatodon* (*Indogrammatodon*) *virgatus* (J. de C. Sowerby) (Cox, 1937) in general shape but radial ribs are much finer. *Grammatodon takiensis* Kimura from the same district is very similar to this at a sight. The more anterior and non-inflated umbo, obliquely dilated shape and more distinct radial ribs on the middle part easily distinguish this from *G. takiensis*. The middle radial ribs are generally invisible or very feeble in *G. takiensis*, if observed. The greatest specimen of *G. takiensis* is no more than 18 mm in length but all of *densistriatus* in hand exceed 20 mm in length.

Occurrence:—5th zone at Loc. 8.

Genus *Catella* Healey, 1908

Subgenus *Torinosucatella* Tamura, 1959

Catella (*Torinosucatella*) *kobayashii* Tamura

Plate 19, Figures 7, 8.

1959. *Catella* (*Torinosucatella*) *kobayashii*, Tamura, p. 55, pl. 6, figs. 11-16.

The external constriction of surface in the Soma form is weaker than in the Sakamoto form. The inflation near umbo is sometimes (MM 3206) prominent.

Occurrence:—7th zone at Locs. 13, 15; 8th zone at Loc. 14.

Family Nuculanidae

Genus *Nuculana* Link, 1807

Subgenus *Dacryomya* AGASSIZ, 1840

Nuculana (*Dacryomya*)
stenodolichos KIMURA

Plate 19, Figure 40.

1956. *Nuculana* (*Dacryomya*) *stenodolichos*, KIMURA, p. 83, pl. 1, fig. 1.
1959. *Nuculana* (*Dacryomya*) *stenodolichos*, TAMURA, p. 57, pl. 6, figs. 17–19.

Occurrence:—One poorly preserved internal mould of a right valve from the 8th zone at Loc. 14.

Family Pectinidae

Genus *Chlamys* BOLTEN MS, RÖDING, 1798

Chlamys camptonectoides
TAMURA, new species

Plate 19, Figures 16, 17.

Description:—Shell small to medium in size, inequivalve, nearly equilateral exclusive of auricles, elongate orbicular and much higher than long. Right valve depressed; hinge-margin straight; anterior auricle a little larger than posterior; both extremities of auricles acute-angled; byssal sinus below anterior auricle deep; anterior and posterior dorsal margins nearly straight; apical angle about 70°; ventral margin semicircular; surface covered by numerous (80 or more) radial ribs and fairly distinct concentric ribs; radials slightly scaly; secondary riblets sometimes inserted. Left valve moderately convex; concentric lines of growth not so strong and regular as in right valve; radial ribs stronger and coarser and more regularly inserted by secondary riblets than in right valve.

Measurements:—	L	H
Left valve (MM3209)	18 mm	24 mm
Left (MM3210)	7	9
Right (MM3211)	7	9
Right (MM3212)	8	10

Observation and Comparison:—The right and left valves differ in shell convexity and surface ornaments. The writer erected this species chiefly based on its *Camptonectes*-like ornaments. As the radial ribs which are stronger than the concentric ones in both valves, become slightly scaly and run straight, it is sure that this can be involved in *Chlamys*. *Pecten* sp. (DECHASEAUX, 1936) from the Oxfordian of Paris Basin is somewhat similar to this species but the concentric ribs are feeble and radials more scaly than *Ch. camptonectoides*.

Occurrence:—7th zone at Loc. 15 and 8th zone at Loc. 14.

Chlamys sp.

Plate 19, Figures 30, 31.

Shell medium to large for genus, inequilateral, nearly as high as long, somewhat quadrate in outline. Right valve highly inflated, inequilateral and extending antero-ventrally; umbo at about 1/4 from posterior end; hinge-line straight; anterior auricle twice or more as long as posterior, byssal sinus below anterior auricle deep; dorsal margins nearly straight and apical angle 90° or less; ventral margin rounded; surface with 30 or more radial ribs.

Two internal moulds of right valve at hand lack ventral parts. The inflated right valve and the large anterior wing are two characteristics. The details of the ornaments are, however, unpreserved. This form, however, differs

distinctly from Jurassic *Chlamys* ever described from Japan in its large and inflated form.

Occurrence:—5th zone at Loc. 5.

Subgenus *Radulopecten* Rollier, 1911

Chlamys (*Radulopecten*) *ogawensis* (Kimura)

Plate 19, Figures 23-26.

1951. *Aequipecten ogawensis*, Kimura, p. 343, pl. 1, fig. 7.
1959. *Chlamys* (*Radulopecten*) *ogawensis*, Tamura, p. 58, pl. 6, fig. 37.

Pectinids are poor in the Soma Jurassic in number of both species and individuals. But this species is more common here than in the Sakamoto formation, and probably attains 30 mm in height. Fine growth-lines are distinct and the test is thin in the Soma form.

Occurrence:—5th zone at Locs. 2, 7, 8; 6th zone at Loc. 5; 8th zone at Loc. 14.

Genus *Camptonectes* Meek, 1864

Camptonectes sp.

Plate 19, Figure 28.

Shell medium (25 mm long), fairly convex, equilateral exclusive of ears, orbicular and higher than long; hinge margin straight; anterior ear twice or more as long as the posterior; dorsal margins straight and disposed subrectangularly; ventral probably rounded; surface with fine fan-wise radiating ribs; a short fine ridge and furrow below hinge margin and a ridge on anterior ear of interior.

The sole internal mould of the left valve at hand has fine fan-wise radials characteristic of the genus. In the unequal ears and shell form, this is very similar to *Entolium japonicum* from the Upper Jurassic of Sakawa basin (Kimura, 1951) has no radial ornaments but one of Kimura's specimen (MM7103) resembles this in form. *C.* sp. aff. *browni* Cox from the Sakamoto formation (Tamura, 1959) is easily distinguished from it in the small anterior ear.

Occurrence:—5th zone at Loc. 7.

Genus *Aequipecten* Fischer, 1887

"*Aequipecten*" *kotsubu* (Kimura)

1951. *Neithea kotsubu*, Kimura, p. 343, pl. 1, figs. 8, 9.
1959. "*Aequipecten*" *kotsubu*, Tamura, p. 58, pl. 6, figs. 33, 34.

Occurrence:—One internal mould of a right valve from 5th zone at Loc. 2.

"*Aequipecten*" *vulgaris* Kimura

Plate 19, Figure 22.

1951. *Aequipecten vulgaris*, Kimura, p. 342, pl. 1, figs. 5, 6.
1959. "*Aequipecten*" *vulgaris*, Tamura, p. 58, pl. 6, figs. 40, 41.

Occurrence:—5th zone at Locs. 2, 7.

Genus *Eopecten* Douvillé, 1897

Eopecten punctus (Kimura)

Plate 19, Figures 18-21.

1951. *Eopecten puncta*, Kimura, p. 348, pl. 1, fig. 21.

Description:—Shell small to medium, strongly inequivalve, inequilateral, nearly orbicular in outline. Right valve flat; numerous radial ribs and several weak concentric striae on surface. Left valve moderately convex, more or less

diagonally elongated; hinge margin straight; anterior auricle not clearly demarcated from shell body, no less than twice the depressed posterior one; sinus below anterior auricle shallow; furrow between shell body and posterior ear distinct, narrow; apical angle about 90° or less; ventral margin nearly rounded but angulated by radial ribs; these ribs crest-like on top about 9 and ridge-like in shell body and 4 or so on anterior auricle; a secondary rib inserted in each pair; tertiary radials fine; several concentric wrinkles distinct near umbo.

Measurements:—	L	H
Left valve (MM3220)	12 mm	13 mm
Left (MM3221)	20	19

Observation and Comparison:—A fragmentary right valve is allied to *Eopecten punctus* (KIMURA) from the Torinosu group of Sakawa. Several left valves allied to *Eopecten* in its peculiar ornaments occur together with the fragments of *Eopecten punctus*. *Eopecten* sp. from the Sakamoto formation (TAMURA, 1959) differs from this species in surface ornaments which are seen on an internal mould of a left valve. They are approximate to those of the right valve of *Eopecten punctus* in form and size. From these facts these specimens are considered probably the left valves of *punctus*. *Eopecten aubryi* (DOUVILLÉ) from the Jurassic of Cutch is close to it in ornaments. But the primary radial ribs are 12 and concentric wrinkles indistinct in *E. aubryi*.

Occurrence:—5th zone at Loc. 2; 7th zone at Loc. 15.

Family Amusiidae

Genus *Entolium* MEEK, 1865

Entolium yatsujiense KURATA and KIMURA

Plate 19, Figure 41.

1951. *Entolium yatsujiense*, KIMURA, p. 346, pl. 1, figs. 18a, b.
1959. *Entolium yatsujiense*, TAMURA, p. 60, pl. 6, fig. 30.

Occurrence:—Restricted in 6th zone at Locs. 5, 16.

Entolium kimurai TAMURA

Plate 19, Figure 27.

1959. *Entolium kimurai*, TAMURA, p. 60, pl. 6, figs. 23-29.

Two kinds are distinguished in this species from the Sakamoto formation. Soma specimens belong to the form whose apical angle is 100° or more and the height is nearly equal to the length. It is smaller than the Sakamoto form on an average.

Occurrence:—Restricted to the sandy shale (10th zone) of Koyamada formation at Umazawa (Loc. 11) and Locs. 9, 10.

Genus *Somapecten* KIMURA, 1951

Somapecten kamimanensis KIMURA

Plate 19, Figure 29.

1951. *Somapecten kamimanensis*, KIMURA, p. 347, pl. 1, figs. 19, 20.
1959. *Somapecten kamimanensis*, TAMURA, p. 62, pl. 6, figs. 50-55.

Two kinds of shell outline are recognized in this species, namely, a quite orbicular form and a tall ovate form. The latter occurs at Sakamoto, Yatsuji and Kurisaka and the other at Sakamoto and Soma. Sakamoto specimens are mostly high. These two kinds are probably inseparable specifically at present.

Occurrence:—5th zone at Locs. 7, 8 and 6th zone at Loc. 1.

Family Limidae

Genus *Lima* Bruguière, 1792

Subgenus *Ctenoides* Mörch, 1853

Lima (*Ctenoides*) *tosana* Kimura

1951. *Lima* (*Ctenoides*) *tosana*, Kimura, p. 349, pl. 1, figs. 22a, b.
1959. *Lima* (*Ctenoides*) *tosana*, Tamura, p. 62, pl. 6, figs. 44-47.

Occurrence:—An external mould of a broken right valve from 5th zone at Loc. 2.

Subgenus *Plagiostoma* Sowerby, 1814

Lima (*Plagiostoma*) *enormicosta* Tamura, new species

Plate 19, Figures 32-34.

Description:—Shell large to medium in size, moderately convex and most convex at a little above mid-height, subtrigonal, height a little less than or nearly equal to length (70 mm long, 65 mm high in holotype specimen); umbonal angle about 90°; anterior umbonal ridge well defined and of moderate length; lunule long; anterior auricle much smaller than posterior one which is indistinctly demarcated with shell body; anterior margin straight; posterior and ventral rounded but a little concave in part below posterior auricle; radial ribs about 30, fairly irregularly disposed, flat-topped and narrower than their interspaces; median ribs and interspaces wider than lateral ones; posterior auricle ribbed in same way but finer; lunule finely striated but not ribbed; margin crenulated roughly; ligament pit triangular, fairly large, deep, a little posterior to umbo and extending posteriorly; adductor scar fairly large, oblong, located in upper and posterior side.

Observation:—In most specimens the height exceeds the length but sometimes they are nearly equal. The straight radial ribs are characteristic of this species. These ribs and their interspaces become narrower on the lateral sides and the interspaces are wider than the ribs. Numerous concentric fine threads in the interspaces are characteristic of *Plagiostoma*. The ribs are mostly flat-topped but fairly rounded in some.

Comparison:—*Lima* (*Plagiostoma*) *paolii* Stefanini (1938) from the Somaliland Jurassic is very close to it in general feature but the flat-topped ribs, their irregular arrangement and wide interspaces distinguish it from *paolii*.

Occurrence:—5th zone at Locs. 5, 7, 8.

Lima (*Plagiostoma*) sp.

Plate 19, Figure 39.

Shell large (80 mm or more high), slightly convex, oblong and higher than long; posterior auricle fairly large and depressed; ribs ridge-like, about 40, as wide as their interspaces which bear fine transverse threads.

This species differs from *L.* (*C.*) *enormicosta* in tall outline and mode of ribbing. *Lima* (*Plagiostoma*) *paolii* is closely allied to it in its shape, radial ribs and their number but their interspaces are punctated in that species.

Occurrence:—5th zone at Loc. 2.

Genus *Ctenostreon* d'Eichwald, 1862

Ctenostreon proboscideum (J. Sowerby)

Plate 19, Figure 38.

1820. *Lima proboscidea*, J. SOWERBY, p. 115, pl. 264.
1932. *Ctenostreon proboscideum*, ARKELL, W.J., p. 145, pl. 15, fig. 3.
1935. *Ctenostreon proboscideum*, COX, L. R., p. 14, pl. 1, fig. 16.
1936. *Ctenostreon proboscideum*, DECHASEAUX, C., p. 43.
1952. *Ctenostreon proboscideum*, COX, L. R., p. 64, pl. 5, figs. 13, 14.

Description:—Shell small (ca. 45 mm long; 55 mm high), moderately convex, appreciably inequilateral, irregularly suborbicular in outline and higher than long; auricles and umbonal part unknown; ventral margin irregularly rounded; radial ribs 10 or more, squamous, high, equal to or narrower than their interspaces, covered by concentric growth-lines which are more conspicuous on sulci than ribs.

Observation:—A sole specimen at hand is probably an incomplete right valve as judged from its obliquity. Whether the number of its ribs serves for discrimination from *Ctenostreon* is a matter of discussion. But it is undeniable that the number varies in *Ctenostreon*. According to COX (1952) radials are 12 in typical *Ct. proboscideum* and 10 in typical *Ct. pectiniforme* from the Inferior Oolite of the type area (SE Germany). Some Indian *proboscideum*, however, has 11 ribs. Therefore the writer referred the Soma form to *P. proboscideum*. The vertical range of *pectiniformae* does not extend to Malm.

Occurrence:—5th zone at Loc. 2. Reported from upper Bathonian or Callovian to Rauracian of Asia and Europe.

Family Plicatulidae

Genus *Plicatula* LAMARCK, 1801

Plicatula dichotomocosta TAMURA, new species

Plate 19, Figures 35-37.

Description:—Shell large for genus (41 mm long, 36 mm high in holotype), inequivalve, subequilateral, ovate, longer than high and a little extending posteriorly; hinge-line relatively long and straight; dorsal and ventral margins rounded. Right valve slightly convex; attachment area narrow; radial ribs about 20, much narrower than their interspaces, dichotomizing ventrally, sometimes tuberculate or nodose but not spiniferous; several concentric wrinkles intersect radials; internal margin crenulate; two ctenoria below hinge deep and divergent. Left valve concave, ornamented as right valve.

Observation:—External and internal moulds of nearly complete right valves beside a few broken valves are at hand. The shell outline is very variable. The holotype is longer than high and equilateral. But the height often exceeds the length and the valve is elongated backward. Most ribs dichotomize.

Comparison:—This resembles *Plicatula peregrina* D'ORBIGNY and *Plicatula cossmanni* LORIOL from the Callovian of Somaliland (STEFANINI, 1938) closely. Its ribs are more numerous and mostly dichotomize. The shell is plano-convex in them. *P. cochlear* STEFANINI (1938) from a little higher horizon than that of *P. cossmanni* is more strongly convex than this species. COX placed that species into *P. peregrina* (COX, 1952).

Occurrence:—5th zone at Locs. 5, 7.

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Explanation of Plate 19

Grammatodon takiensis Kimura

Figs. 1, 2. Internal mould and clay cast of an external mould of a left valve; Loc. 12; ×1.5. (MM3199).

Fig. 3. Internal mould of a bivalved shell; Loc. 11; ×1.5. (MM3200).

Grammatodon (*Indogrammatodon*) *densistriatus* Tamura, new species

Fig. 4. Clay cast of an external mould of the new species holotype, left valve; Loc. 8; ×1.5. (MM3202).

Fig. 5. Internal mould of a bivalved shell; Loc. 8; ×1. (MM3203).

Fig. 6. Clay cast of a left valve; Loc. 8; ×1. (MM3205).

Catella (*Torinosucatella*) *kobayashii* Tamura

Figs. 7, 8. Internal moulds of left valves (with thin test fragments); Loc. 15; ×1.5. (MM3206, 3207).

Parallelodon koikensis Tamura, new species

Fig. 9. Internal mould of a broken right valve (with thin test fragments); Loc. 15; ×1.5. (MM3194).

Fig. 10. Internal mould of the holotype left valve (with thin test fragments); Loc. 15; ×1.5. (MM3193).

Fig. 11. Internal mould of the holotype left valve (with thin test fragments); Loc. 15; ×1.5. (MM3195).

Parallelodon sp. aff. *inflatus* TAMURA

Figs. 12, 15. Clay casts of the external moulds of left valves; Loc. 12; ×1. (MM3197, 3198).

Figs. 13, 14. Internal mould and the external mould of a right valve; Loc. 12; ×1. (MM3196).

Chlamys camptonectoides TAMURA, new species

Fig. 16. Internal mould of the holotype right valve with thin test; Loc. 14; ×2. (MM3212).

Fig. 17. Left valve; Loc. 15; ×1. (MM3209).

Eopecten punctus (KIMURA)

Fig. 18. Interior of a broken valve; Loc. 15; ×1. (MM3222).

Figs. 19, 21. Internal mould (×1.5) and clay cast of an external mould (×1) of a left valve; Loc. 15. (MM3221).

Fig. 20. Left valve; Loc. 15; ×1.5. (MM3220).

"Aequipecten" vulgaris KIMURA

Fig. 22. Internal mould of a left valve; Loc. 7; ×2. (MM3219).

Chlamys (*Radulopecten*) *ogawensis* (KIMURA)

Fig. 23. Internal mould of a left valve; Loc. 5; ×1.5. (MM3215).

Fig. 24. Internal mould of a valve; Loc. 8; ×2. (MM3216).

Figs. 25, 26. Clay casts of an external and an internal moulds of a left valve; Loc. 14; ×1.5. (MM3217).

Entolium kimurai TAMURA

Fig. 27. Internal mould of a left valve; Loc. 11; ×1.5. (MM3224).

Camptonectes sp.

Fig. 28. Internal mould of a left valve; Loc. 7; ×1. (MM3218).

Somapecten kamimanensis KIMURA

Fig. 29. Internal mould of a left valve; Loc. 8; ×1. (MM3225).

Chlamys sp.

Figs. 30, 31. Internal moulds of right valves; Loc. 2, 5; ×1. (MM3213; 3214)

Lima (*Plagiostoma*) *enormicosta* TAMURA, new species

Figs. 32, 33. Clay cast of an external mould of a left valve and an internal mould of a left valve; Loc. 2; ×1/2. (MM3226, 3227).

Fig. 34. Internal mould of the holotype right valve; Loc. 2; ×1. (MM3228).

Plicatula dichotomocosta TAMURA, new species

Fig. 35. Clay cast of the external mould of a right valve; Loc. 7; ×1. (MM3232).

Fig. 36. External mould of a left valve; Loc. 7; ×1. (MM3233).

Fig. 37. Internal mould of the holotype right valve; Loc. 7; ×1. (MM3234).

Ctenostreon proboscideum (J. SOWERBY)

Fig. 38. Clay cast of an external mould of a right valve; Loc. 2; ×1/2. (MM3231).

Lima (*Plagiostoma*) sp.

Fig. 39. Clay cast of an external mould of a right valve; Loc. 2; ×1/2. (MM3230).

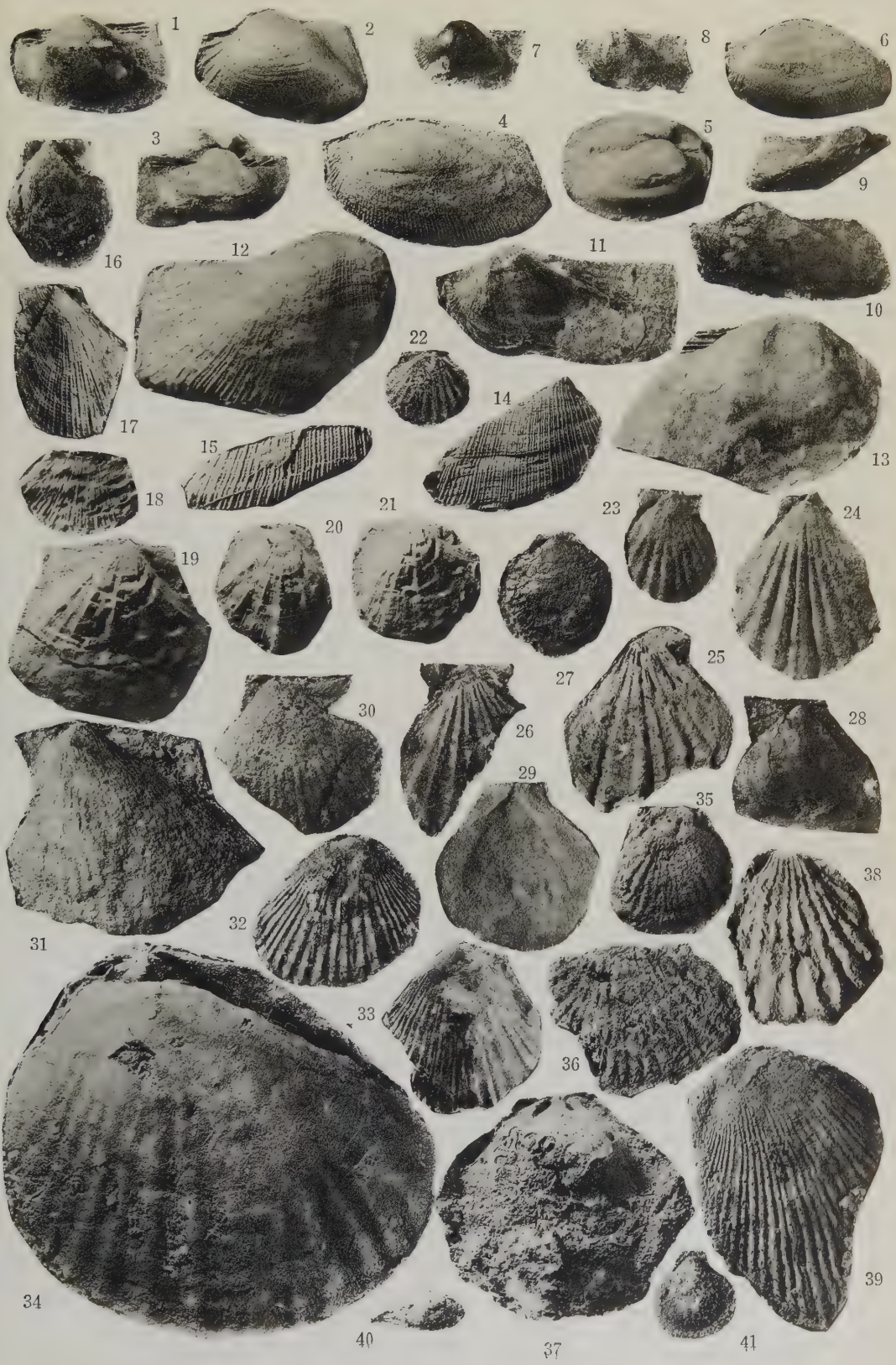
Nuculana (*Dacryomya*) *stenodolichos* KIMURA

Fig. 40. Internal mould of a right valve; Loc. 14; ×2. (MM3208).

Entolium yatsujiense KURATA and KIMURA

Fig. 41. Internal mould of a left valve; Loc. 16; ×2. (MM3223).

All specimens here illustrated are kept in the Geological Institute, University of Tokyo.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374. TWO NEW PERMIAN CORALS FROM YAMAGUCHI PREFECTURE*

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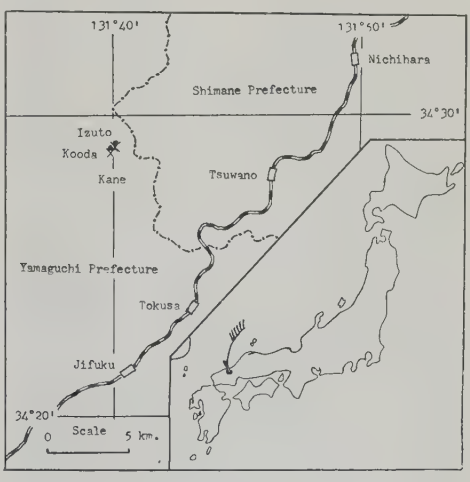
山口県産二畳紀珊瑚の 2 新種：山口県北部の阿東町嘉年附近より採集した四射珊瑚 *Huangia?* の新種 *H.? kanensis* と六射珊瑚 *Pseudopavona taisyakuana* の新亜種 *P. taisyakuana izutoensis* を記載した。ともに鹿足層群下部の嘉年層中のレンズ状石灰岩より産したもので，この石灰岩からは *Neoschwagerina margaritae* (DEPRAT) を産するので時代は二畳紀中部と考えられる。従来，*Pseudopavona* は *taisyakuana* の 1 種のみが石炭紀中部より報告されていた。

河野通弘

Introduction and Acknowledgements

During the writer's geological studies of the Paleozoic rocks distributed in the Mino-Kanoashi Massif in the western part of Shimane Prefecture and the northern part of Yamaguchi Prefecture, fossils of fusulinids and corals were discovered from the Izuto limestone. The limestone is a lens embedded in the Kane formation and has yielded corals of the genera *Pseudopavona*, *Huangia*?, *Waagenophyllum* and others, among which two new species are described in this article.

The Paleozoic formations developed in the southwestern part of the above stated massif have already been reported by the writer (KAWANO et al., 1956). Among the Paleozoic formations the Kane is particularly fossiliferous in its two limestone lenses. The formation consists of sandstone, slate, chert and limestone lenses. Its general strike is N 40°-60°W, and inclines at angle of 50°-60°NE, constructing in the Kane district a monoclinal structure. Near Kane there are two limestone lenses, the lower is known as the Kooda limestone and the upper the Izuto limestone. The former is typically developed at Kooda and consists of limestone conglomerate or limestone breccia, from which the following fossils have been discriminated, namely:



Text-figure: Map showing the locality.

Climacamina sp.
Ozawainella sp.
Schubertella kingi DUNBAR and SKINNER
Triticites cf. *ellipsoidalis* TORIYAMA
Schwagerina krotowi (SCHELLWIEN)

* Received at Jan. 29, 1959; read at the Annual Meeting of the Palaeontological Society of Japan at Tokyo, Dec. 7, 1958.

Schwagerina sp.
Pseudofusulina vulgaris (SCHELLWIEN)
P. vulgaris var. *globosa* (SCHELLWIEN)
P. vulgaris var. *megaspherica* TORIYAMA
Parafusulina sp.
Pseudodoliolina? sp.
Corals gen. et sp. indet.

The Izuto limestone is developed at about 300 meters north of the Kooda limestone. This limestone is a lens measuring about 70 meters in thickness and about one kilometer in length and consists of white slightly crystallized limestone barren of fossils in general. However, at the Abu limestone quarry, it contains small dark gray masses with densely crowded specimens of *Neoschwagerina margaritae* (DEPRAT), *Parafusulina* sp., *Schwagerina* sp., and others. *Huangia*? n. sp. was obtained from this locality where it occurs in association with *Neoschwagerina margaritae* (DEPRAT). About 50 meters north of the Abu limestone quarry there occur abundant remains of crinoid stems, *Waagenophyllum* and *Pseudopavona*, the latter of which is described in this article.

From the evidence afforded from the fusulinids, the Kooda and Izuto limestone indicate that the age of the Kane formation is Middle Permian.

The writer wishes to express his most sincere thanks to Prof. Motoki EGUCHI and Prof. Kotora HATAI of the Tohoku University, who gave their kind suggestions and criticism concerning the corals dealt with and read through the typescript.

Description of the Species

Order Tetracoralla HAECKEL

Family Clisiophyllidae NICHOLSON and THOMSON, 1883

Genus *Huangia* YABE, 1950

Huangia? *kanensis* KAWANO, n. sp.

Plate 20, Figures 3-8.

Corallum fasiculate, corallites usually aggregated closely. Corallites rather small, calicular diameter ranging from five to six millimeters at maturity. Calyx deep, wall thick. Septa in two orders. Major septa extend to central area, some unite directly with septal lamellae of columella at maturity, not joining with columella in young. Minor septa short, developed at maturity. Columella solidified by stereoplasma, loosely constructed and irregularly of axial tabellae and septal lamellae, median plate present but not typical. Dissepimentarium broad. Tabulae present but sparse.

In longitudinal section, dissepiments loosely arranged in one or two orders, their convex sides facing inwards. Tabulae arranged sparsely and descending steeply towards columella, their convex sides facing inwards like dissepiments to construct central column.

Calicular diameter and corresponding major septal number of each corallite are as follows.

2.8 mm.....12	4.0 mm.....17
3.0 mm.....14	4.6 mm.....18
3.6 mm.....14	5.0 mm.....20
3.6 mm.....16	5.2 mm.....20
4.0 mm.....16	

Remarks:—In transverse section the present new species resembles *Yatsengia asiatica* HUANG, the genotype of *Yatsengia* YOH and HUANG, 1932, and *Yatsengia ibukiensis* MINATO reported from the *Parafusulina* zone of the Ibuki district and othe localities in Japan. But in longitudinal section, the present species can be distinguished therefrom by the

details of its structure, which are most related to the genus *Huangia* Yabe, 1950. The characters described above are remote from any previously described species of *Huangia* and therefore, the writer refers it to the named genus with the reservation that it may represent an undescribed genus.

Occurrence:—Limestone at the Abu quarry, Izuto, Kane District, Ato-cho, Yamaguchi Prefecture.

Order Hexacoralla Haeckel

Family Pseudopavoniidae Yabe, Sugiyama and Eguchi, 1943

Genus *Pseudopavona* Yabe, Sugiyama and Eguchi, 1943

Pseudopavona taisyakuana izutoensis Kawano, n. subsp.

Plate 20, Figures 1, 2.

Corallum composite, massive, meandroid. Corallites small, three to four millimeters from center of adjacent corallites, calices arranged sporadically. In transverse section, each corallites with no wall, connected by perfectly confluent septa. Diameter of calices less than two millimeters. Calicular area with 10–20 septa, distinction between major and minor septa not clear, apparently disposed radially and almost straight. Some septa in contact with columella, structure indistinct. Tabulae partly present. Septa of so-called trabecular septa, trabeculae consist of distinct fibrous tissue, exhibit sawteethed structure on both sides of septa in outer part of calicular area.

In longitudinal section, septa composed of numerous trabeculae consisting of radiating fibers, nearly straight, subparallel and slightly curved. Tabulae and dissepiments present in axial part and sometimes in interseptal part.

Remarks:—The genus *Pseudopavona* was originally established by Yabe, Sugiyama and Eguchi (1943) based upon a hexacoral-like Carboniferous coral from the Taisyaku limestone, and for it the new family Pseudopavoniidae of the order Haxacoralla was introduced by them. Hitherto only the genotype, *Pseudopavona taisyakuana* Yabe, Sugiyama and Eguchi has been recorded from Japan; this is a Middle Carboniferous species. Aside from its type locality, T. Yokoyama (1957) recorded it from other localities of the Taisyaku limestone. The new subspecies described in this article serves to extend the geological range of the genus up to the Middle Permian.

The material now at hand in having meandroid corallum, corallites lacking a proper wall and being connected by confluent trabecular septa, show considerable resemblance with the genotype species, *Pseudopavona taisyakuana*. *Orionastraea* sp. described by I. Hayasaka (1932) from the Omi limestone shows superficial resemblance with the present species.

Compared with the Taisyaku species, the present specimens are smaller in size and exhibit a somewhat different structure of the calices, by which it is distinguished therefrom.

In association with the present new subspecies there were found *Waagenophyllum* sp. and other unidentified corals and abundant remains of an unidentified crinoid, mostly represented by its stems.

From the occurrence of *Huangia? kanensis* Kawano, n. sp. in association with *Neoschwagerina margaritae* (Deprat) from the Abu limestone quarry, which belongs to the Izuto limestone, it is

considered that the Izuto is Middle Permian in age and referable to the *Neoschwagerina* zone.

Occurrence:—Izuto limestone of the Kane District, Ato-cho, Yamaguchi Prefecture.

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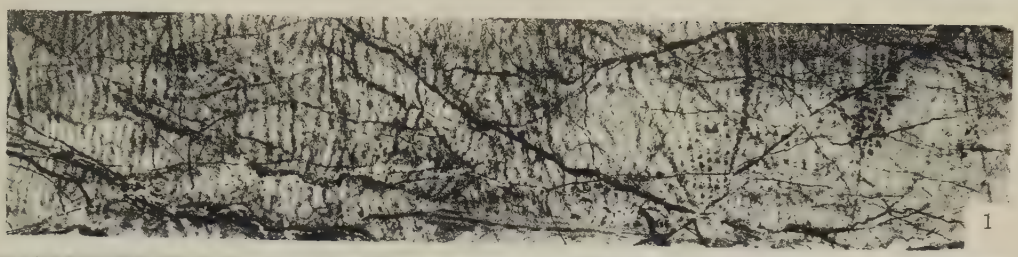
Explanation of Plate 20

Figs. 1, 2. *Pseudopavona taisyakuana izutoensis* KAWANO, n. subsp.
1; Longitudinal section: ×4
2; Transverse section: ×4

Figs. 3 8. *Huangia? kanensis* KAWANO, n. sp.
3; Longitudinal section: ×4
4, 6, 7; Transverse section: ×4
5, 8; Transverse and longitudinal sections: ×4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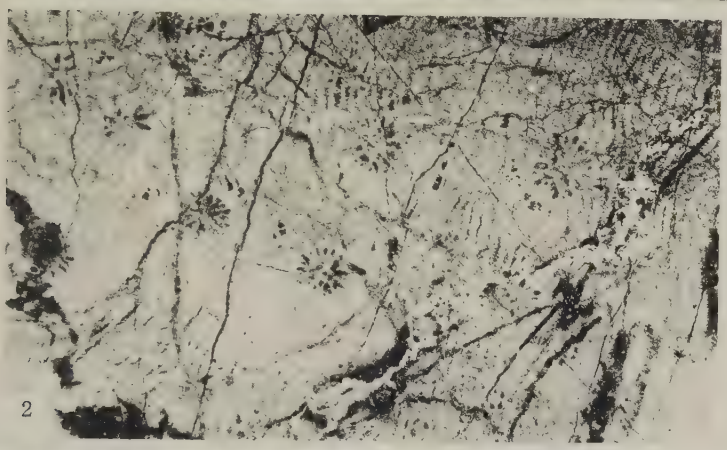
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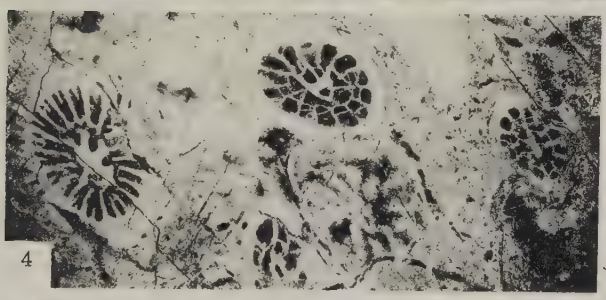
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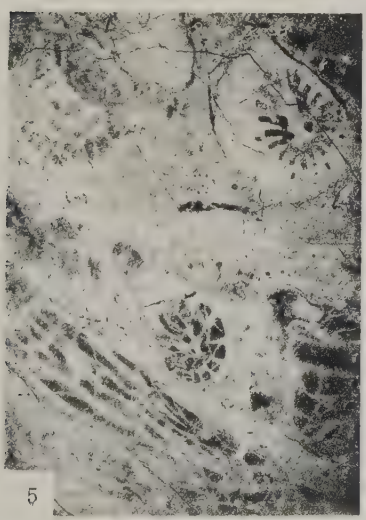
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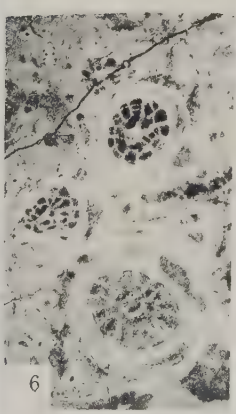
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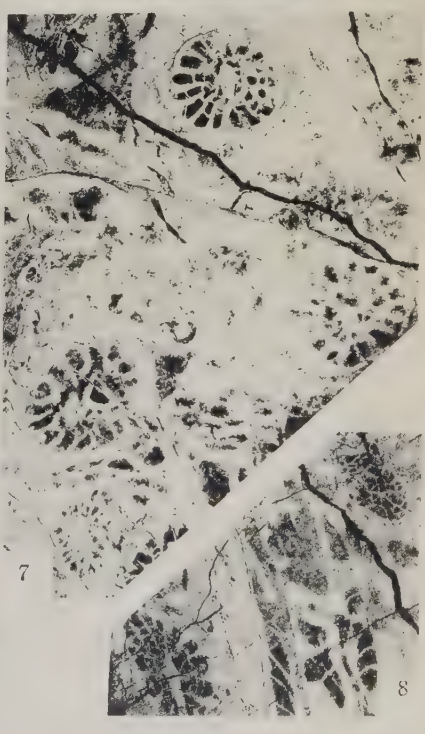
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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 36, pp. 185-191, pls. 21, 22, Nov. 30, 1959

375. ELECTRON-MICROSCOPIC FINE STRUCTURE OF FOSSIL DIATOMS. VI*

Stereoscopic Observation

HARUO OKUNO

Kyoto University of Textile Fibers

化石珪藻の電子顕微鏡的微細構造. VI: 米国ネバダ州チャーチル郡ファロン町南方15哩の地点産の珪藻土に多量に含まれる鹹水性化石珪藻 *Terpsinoë americana, Dimerogramma dubium, Navicula maculata* var. *gigantea, Amphora proteus, Surirella striatula* var. *brevis, Campylodiscus Kützingii* 及びその新変種 var. *cocconeiformis* の電子顕微鏡的微細構造を記した。今回はそれぞれの化石珪藻について電子顕微鏡立体写真撮影法による精査を行い，珪殻の立体的微細構造をかなりくわしく解明することが出来た。研究に用いた珪藻土原土はその原採集者である米国グレートレーク・カーボン会社技師マツクミラン氏より寄贈されたものであり，同氏の御厚意に対して深く感謝の意を表する。 奥野春雄

This study is based upon the crude diatomaceous earth sent me from Mr. R. S. MacMillan[1] in 1957. In his explanation about the earth, he wrote as follows: "The deposit is located in the state of Nevada, in Churchill County about 15 miles south of the town of Fallon. It is thought to be either Upper Miocene or Lower Pliocene. I find this occurrence to be most interesting of any lake deposit which I have so far encountered. This is the only diatomite, of this character, in the 'Basin and Range Province', so far as I know and I have examined several hundred occurrences. No development has been done on this deposit. It is badly contaminated with acidic volcanic ash and has other impurities. It was possibly deposited during the later brackish or saltwater stage of a previously fresh water lake. The formation is locally known as the 'Truckee', farther to the south the correlating formation is known as the 'Esmeralda'. Numerous fresh water diatomaceous deposits occur in both areas."

The diatomaceous earth (Specimen, no. DL-7243; Okuno-m 1168) is white powder of fine particles, and all the fossil diatoms found in it are salt-water littoral forms, without remarkable dominant species. The earth is almost purely composed of fossils of *Terpsinoë americana, Dimerogramma dubium, Navicula maculata* and varr. *acuta, gigantea, inflata, Amphora proteus, Surirella striatula* var. *brevis, Campylodiscus Kützingii* and var. *cocconeiformis,* most of which are found in fragments of their frustules or valves (Text-fig. 1a). Judging from such components and from the absence of fossils of planktonic diatoms[2], it may be fully conclud-

* Received Jan. 26, 1959; read at the 71st Meeting of the Palaeontological Society of Japan, Sept. 27, 1958, at Kyoto.

1) The original collector of the present diatomaceous earth; Geology and Quarry Operation Department, Great Lakes Carbon Cooperation, U. S. A.

2) For example, *Actinocyclus, Actinoptycus, Arachnoidiscus, Coscinodiscus, Stephanopyxis, Triceratium,* which are often found predominantly in many of the marine diatomaceous earth.

ed that the earth, whether it may be of primary or of secondary deposition, is originated in a littoral salt-water.

For the full elucidation of three dimensional character and spatial relation of the elements of fine structure of the frustules, I present here the electron stereo-micrographs of all diatoms dealt with. The pair of the stereo-micrographs was obtained by taking two plane micrographs of each frustule at the same magnification, tilting the frustule about 12 degrees in the electron microscope, between the first and second exposures. View each pair of the stereo-micrographs through a stereoscope with parallel or crossed visual axes. By the view with a stereoscope of parallel visual axes, the image will be exactly the same as the explanation of the "inside view" or the "outside view" in the Plates. On the contrary, by the view with a stereoscope of crossed visual axes, the image will be opposite to the explanation. Further, one can get a stereo-image from the stereo-pair of the micrographs with the naked eyes, after sufficient training of the adjustment of eyes (cf. OKUNO, 1959, *Bot. Mag. Tokyo, vol. 72*, pp. 61-62.).

I wish to express my thanks to Mr. R. S. MACMILLAN who kindly sent me the original sample. This research was aided by a grant in Aid for Scientific Research from the Ministry of Education.

Description of Species

Terpsinoë americana (BAILEY) RALFS

Text-figure 1 b; Plate 21, Figure 1.

Terpsinoë americana (BAILEY) RALFS, A. SCHMIDT, 1895, Atlas Diat., pl. 200, figs. 9-13.——PANTOCSEK, 1903, Foss. Bacill. Ung., vol. 1, pl. 6, fig. 53.——PERAGALLO, 1908, Diat. mar. France, pl. 90, figs. 5, 6.——BOYER, 1916, Diat. Philad., pl. 6, fig. 10; 1926, Synop. North Amer. Diat., pt. 1, p. 145.——HUSTEDT, 1930, Kieselalg., pt. 1, p. 900, fig. 541.——MILLS, 1934, Index, p. 1597.——ZHUSE, PROSCHKINA, SHESHUKOVA, 1949, Diat. Taxonomy, pt. 1, p. 169, pl. 10, fig. 3.——CLEVE-EULER, 1951, Diat. Schweden u. Finnland, pt. 1, p. 128, fig. 288.

Frustules quadrangular in girdle view, with septa ingrowing about half way into the valve. Height of the frustule about 80μ. Valves elliptic, about 80-125μ long, and about 45-60μ broad, with triundulate margins and rostrate ends; divided by two septa into three segments. Central area of the valve hyaline, round or irregularly bordered. Valve surface with radial rows of fine frustule pores about 7-12 in 10μ. Near the end of the valve, the rows of pores often interrupted by a transverse hyaline space.

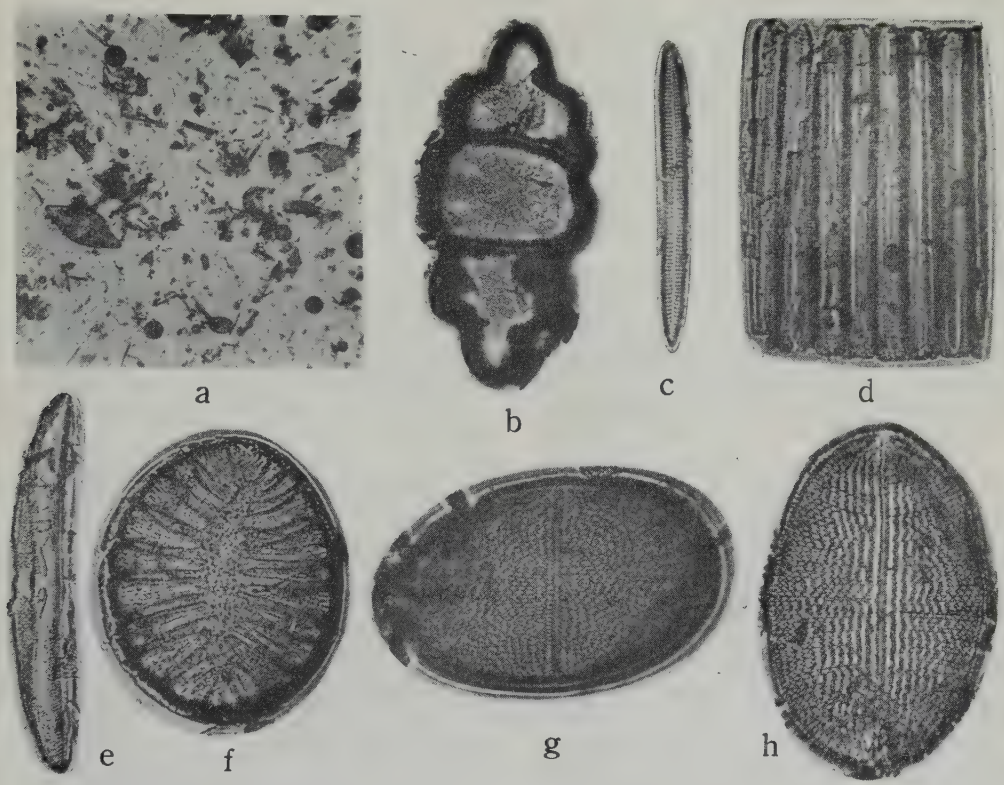
Electron optically, the frustule pore seems to be somewhat locular, closed outwards by a thin irregularly porous sieve membrane, and opens (almost freely ?) inwards with a round opening about 200-400mμ in diameter. In the present research, the details of the lateral wall of the loculus could not be discerned. In many valves the sieve membranes are well preserved.

Dimerogramma dubium GRUNOW

Text-figures 1c, d; Plate 21, Figures 2a, b.

Dimerogramma dubium GRUNOW, VAN HEURCK, 1880-1, Syn. Diat. Belg., pl. 36, fig. 18.——PERAGALLO, 1897-08, Diat. mar. France, pl. 82, figs. 8, 9.——HUSTEDT, 1931, Kieselalg., pt. 2, p. 122, fig. 645.——MILLS, 1934, Index, p. 603.

Frustules quadrangular in girdle view, united in short chains. Valves linear, with parallel margins and cuneate ends;



Text-fig. 1. a, Crude earth (×50). b, *Terpsinoë americana* (×500). c, d, *Dimerogramma dubium* (c, Valve view. d, Chain of frustules. ×500). e, *Amphora proteus* (×400). f, *Surirella striatula* var. *brevis* (×500). g, *Campylodiscus Kützingii* (×800). h, var. *cocconeiformis* (×1000). (a-h, Light micrographs)

about 80-90μ long and 7-10μ broad. Pseudoraphe narrow, about 0.3μ broad, sometimes indistinct. Electron-optically, the frustule pores rounded-rectangular or elliptic, about 450-660mμ long and 200-330mμ broad, arranged in transverse rows about 7-10 in 10μ. The pores seem to be more or less locular, closed probably outwards by a thin sieve membrane with netveins, and opened freely, probably inwards. In many valves, the sieve membranes are well preserved. The valve, on its margin, with an annular row of dentiform spines. The spines lamellar, about 2.5μ long, about 1μ broad, and 8-10 in 10μ, each with a broad basis and a pointed or truncate end. Electron micrographs of such dentiform spines of *Fragilaria construens, crotonensis* and *Cymatosira belgica* are published by Helmcke and Krieger in their Diat. Elektr. Bild, pt. 2, pls. 141, 142, 149.

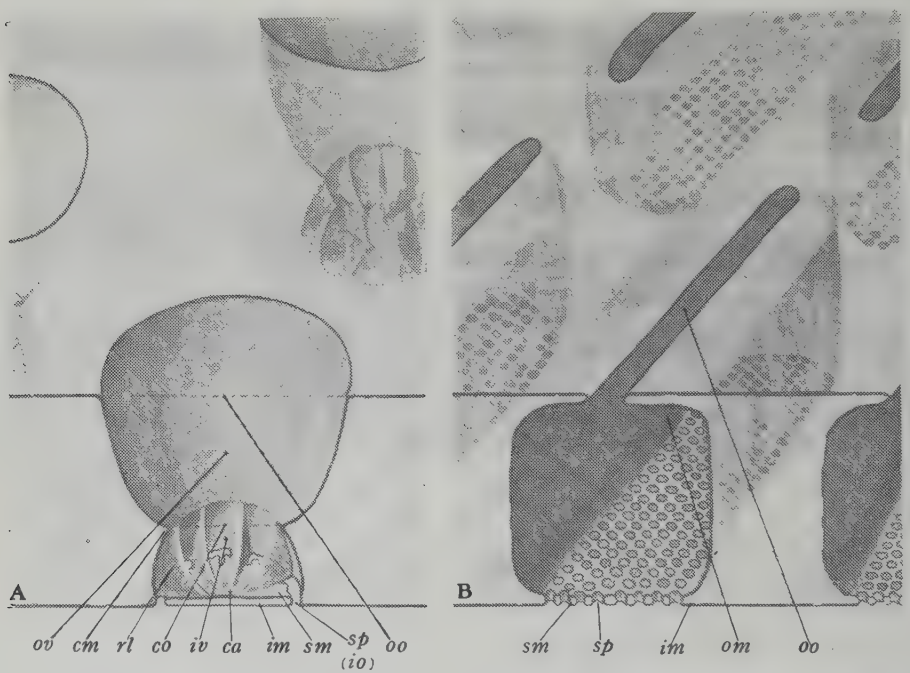
Navicula maculata (Bailey) Cleve var. *gigantea* Okuno

Text-figure 2A; Plate 21, Figure 3.

Navicula maculata (Bailey) Cleve var. *gigantea* Okuno, 1956, *Trans. Proc. Palaeont. Soc. Japan, N. S., No. 21*, p. 134, text-fig. 1,

pl. 22, figs. 5a–c.

I already reported some fine structure of the frustule wall of the present variety revealed by the electron plane-microscopy (OKUNO, 1956). In the present electron stereo-microscopy, I could find a complex structure of the frustule pore as shown in Text-fig. 2A. The frustule pore is locular, somewhat deep funnel-shaped, and seems to be partitioned by a half-closed central membrane into the outer and inner vestibules. The outer vestibule infundibular, opened almost

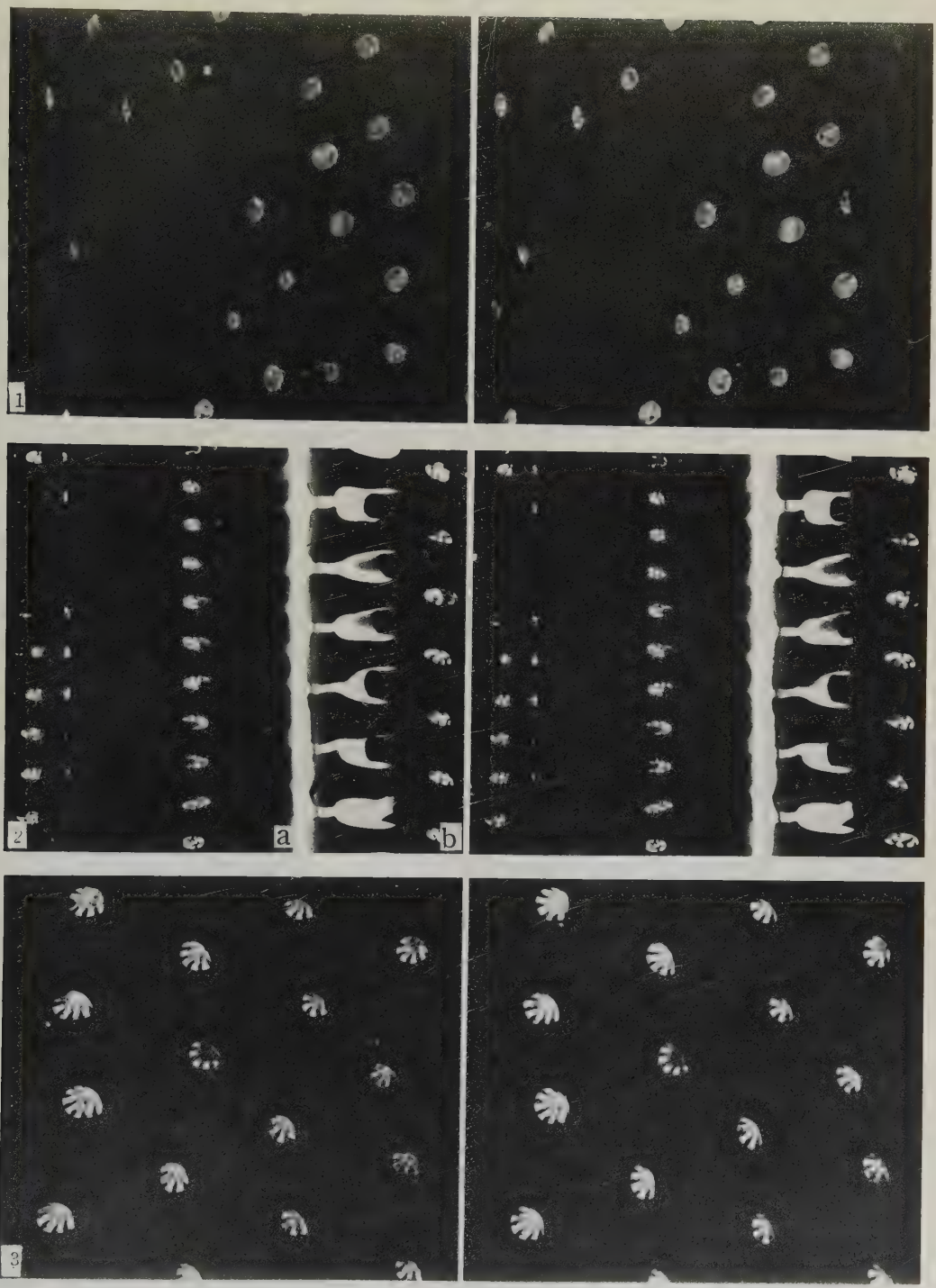


Text-fig. 2. Diagram of the fine structure of loculi, partially presumedly represented. A, *Navicula maculata* var. *gigantea* (cf. Pl. 21, fig. 3). B, *Amphora proteus* (cf. Pl. 22, fig. 1). *ca*, Central area. *cm*, Central membrane. *co*, Central opening. *im*, Inner membrane. *io*, Inner opening. *iv*, Inner vestibule. *om*, Outer membrane. *oo*, Outer opening. *ov*, Outer vestibule. *rl*, Radial lamella. *sm*, Sieve membrane. *sp*, Sieve pore.

Explanation of Plate 21

Pairs of electron stereo-micrographs.

Fig. 1. *Terpsinoë americana* (BAILEY) RALFS. Valve; inside view. (×12500)
Figs. 2a, b. *Dimerogramma dubium* GRUNOW. a, Girdle and mantle; inside view? b, Valve margin, showing spines. (a, ×4500. b, ×6000)
Fig. 3. *Navicula maculata* (BAILEY) CLEVE var. *gigantea* OKUNO. Valve; outside view. (×7500)
Loc. (Figs. 1-3) 15 miles south of Fallon, Churchill Country, Nevada, U. S. A.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a
b
3

freely outwards, and more or less closed inwards by the central membrane. The inner vestibule probably cylindrical, with marginal radial lamellae which divide the vestibule into about 7-12 sectors. The inner and outer vestibules communicate each other through the central opening. The bottom of the inner vestibule is incompletely closed by a delicate inner membrane with radial and marginal slit-like sieve pores of various shapes and sizes (cf. Okuno, l. c., text-fig. 1B). The central area of the inner membrane usually round, scattered with fine sieve pores. The fine structure of the type species, varr. *acuta*, *inflata* are found to be the same to the present variety.

Amphora proteus Gregory

Text-figures 1e, 2B; Plate 22, Figure 1.

Amphora proteus Gregory, A. Schmidt, 1875, Atlas Diat., pl. 27, figs. 2, 3, 5, 6. —Mills, 1933, Index, p. 180. —Lavrenko, 1951, Freshw. Diat., p. 415, pl. 257, fig. 1.

Amphora proteus var. *Karina* Grunow, 1880, Arct. Diat., pl. 1, fig. 7.

Amphora proteus var. *oculata*, Peragallo, 1908, Diat. mar. France, pl. 44, figs. 21, 22.

Frustules elliptical in girdle view, with truncate ends. Valves lunate, each with slightly concave or almost straight ventral margin and convex dorsal margin; length 120-130μ, breadth 20-25μ. Raphe biarcuate. Central hyaline area distinct on the dorsal side. Axial area indistinct on the dorsal side, broad and irregularly bordered on the ventral side. Frustule pores arranged in transverse or slightly radiating rows, about 8-10 in 10μ. Electron optically, the frustule pores locular, linear or linear elliptical, about 0.5-3.0μ long and about 0.5-1.25μ broad. The outer membrane of the loculus with a linear opening, about 100-200 mμ broad; the inner sieve membrane is perforated by numerous round sieve pores arranged in three lines (about 40-50 in 1μ) decussating at about 60 degrees (Text-fig. 2B). In many valves the inner sieve membranes are lost. In living forms of *Amphora ovalis* and var. *pediculus*, the sieve membranes of the same structure were found by Helmcke and Krieger (Diat. Elektr. Bild, pt. 1, pl. 77, pt. 2, pl. 181).

Surirella striatula Turpin var. *brevis* (Ehrenberg) De Toni

Text-figure 1f; Plate 22, Figure 2.

Surirella striatula Turpin var. *brevis* (Ehrenberg) De Toni, Azpeitia, 1911, Diat. Española, p. 200, pl. 12, figs. 8, 9. —Mills, 1934, Index, p. 1540.

Valves broad obovate; 48-100μ long, 48-80μ broad. Wings indistinct. Costae about 7-10 in 100μ, with distinct rows of striae (about 7-9 in 10μ) between each two costae. Central space more or less broad lanceolate. Valve surface scattered with fine spinules. This variety can be distinguished from the type species by its broad central space. Electron optically, the radiating intercostal spaces were ellucidated to be incompletely locular, closed outwards and opened freely inwards. The loculus shallow near the central area and deep to the valve margin. The outer closing membrane of the loculus is perforated by 4-8 transverse double rows of round sieve pores about 50-100mμ in diameter. In each row, the pores about 5 in 1μ. Helmcke and Krieger's electron micrograph of *S. striatula* (living form) in their Diat. Elektr. Bild, pt. 2, p. 18, pl. 200, shows sieve pores without closing membranes

as those of the present fossil.

Campylodiscus Kützingii
BAILEY et HARVEY

Text-figure 1g; Plate 22, Figure 3.

Campylodiscus Kützingii BAILEY et HARVEY, PANTOCSEK, 1903, Foss. Bacill. Ung., vol. 3, p. 26, pl. 30, fig. 433. ——MILLS, 1933, Index, p. 343.
Campylodiscus striolatus GRUNOW, A. SCHMIDT, 1878, Atlas Diat., pl. 53, figs. 1, 2.

Valves elliptical or suborbicular, 17–50μ long, and 16–60μ broad; transapical axis is longer than the apical axis. Frustule pores arranged in slightly radiating rows about 13–18 in 10μ.

var. *cocconeiformis* OKUNO, var. nov.

Text-figure 1 h.

Valvae cocconeiformes, ca. 17–50μ longae, ca. 16–30μ latae; axis apicalis longior quam axis transapicalis.

In this new variety, the apical axis of the valve is always longer than the transapical axis, and the valves are elliptical as in *Cocconeis*.

Specimen, no. m1172—type: Photo, no. LM. 2199.

Both in the type species and in the new variety, the valves seem to be double-lamelliferous, having coarsely and finely porous membranes. The coarsely porous membrane (probably the convex side of the valve) provided with radiating rows of somewhat deep, rectangular loculi about 300–2000mμ long and 200–250mμ broad; the finely porous membrane (probably the concave side of the valve) provided with radiating rows of round pores about 100–200mμ in diameter. In many valves, the finely porous membrane is completely lost.

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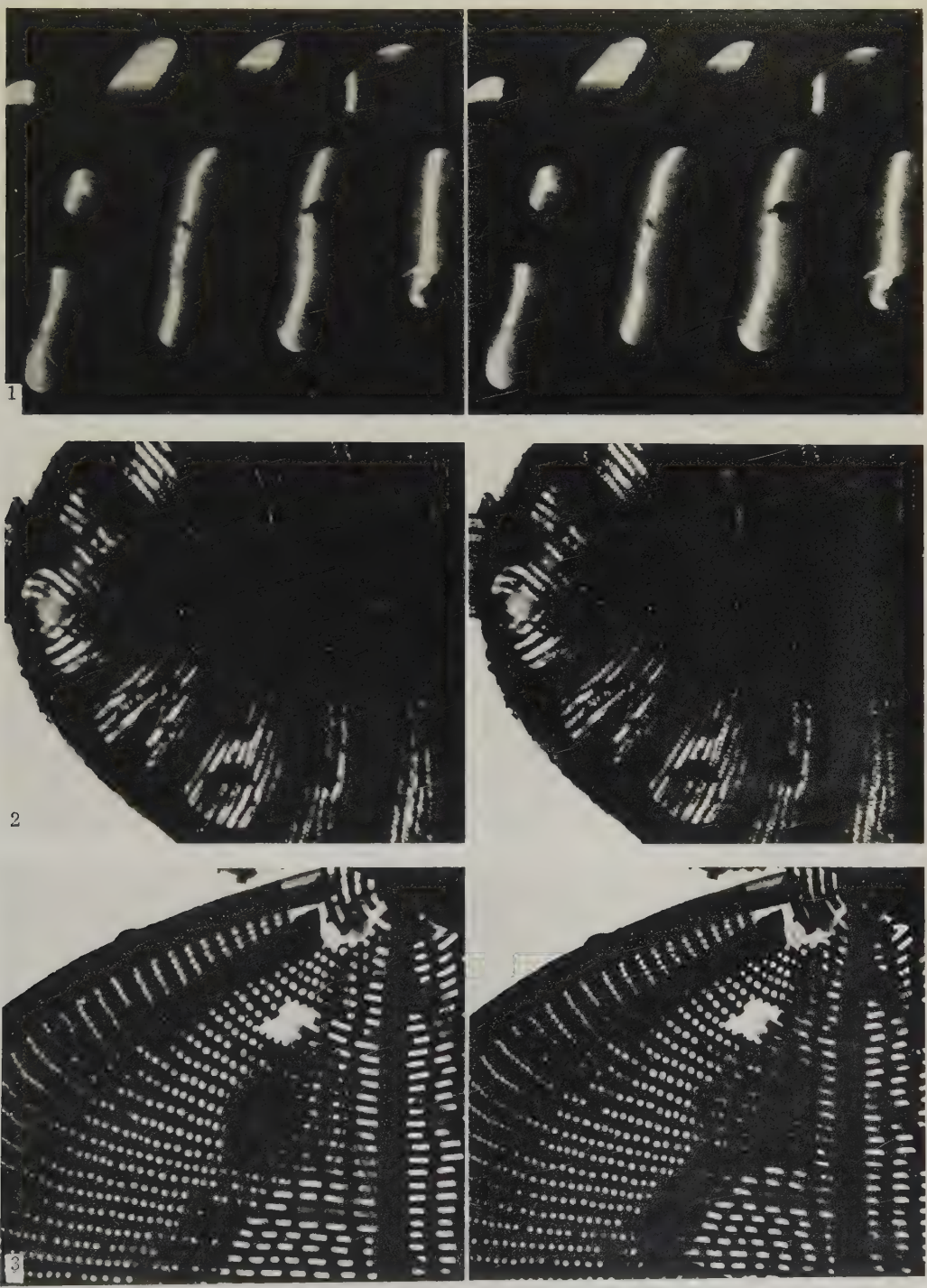
Explanation of Plate 22

Fig. 1. *Amphora proteus* GREGORY. Valve. (×15000)
Fig. 2. *Surirella striatula* TURPIN var. *brevis* (EHRENBERG) DE TONI. Valve; inside view. (×3000)
Fig. 3. *Campylodiscus Kützingii* BAILEY et HARVEY. Valve; inside view? (×3000)
Loc. (Figs. 1–3) 15 miles south of Fallon, Churchill County, Nevada, U. S. A.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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

日本古生物学会第 74 回例会は，1959 年 11 月 21 日，京都大学理学部地質学鉱物学教室において開催された。(参会者 44 名)

特別講演

古生物的進化研究の一方法論 .....首藤次男
日本の第三系と浮游性有孔虫化石 ....浅野 清
古生物の形態発達 .....槇山次郎

例会講演

岡山県阿哲台地産の二畳系の紡錘虫 ..野上裕生
Hayasakapora, a New Permian Bryozoan Genus from Iwaizaki, Miyagi Prefecture, Japan. (代読) .....Sumio SAKAGAMI
Nipponostenopora, a New Carboniferous Bryozoan Genus from Fukuji, Hida Massif, Japan. (代読) ....Sumio SAKAGAMI
Brachiopoda from the Permian Maizuru Group (1) .....Daikichiro SHIMIZU
宮田層から産出する軟体動物化石の或るものについて(宮田層から産出する化石動物群集について，その 1) .....牧野 融
岐阜県瑞浪層群の化石群について ..糸魚川淳二
瑞浪層群産の Pectinidae.....糸魚川淳二
Upper Cretaceous Ammonites of California, Part III. .....Tatsuro MATSUMOTO
白堊紀三角介の化石内容とその変遷について ..... 中野光雄
Zonation of the Non-Marine Upper Mesozoic Wakino Subgroup. ....Yoshihisa OTA
Zur Kenntnis der Oxytominae (Lamellibranchia). .....Koichiro ICHIKAWA
Pelecypods of the Jusanhama Group (Purbeckian or Wealden) in Northeast Japan. .....Itaru HAYAMI
Lower Liassic Lamellibranch Fauna of the Higashinagano Formation in West Japan. .....Akira TOKUYAMA
北上山地二畳系産の Nautiloid の一新種.... ..... 中沢圭二
Some Ordovician Fossils from East Tonkin, Viet-Nam. .....Teiichi KOBAYASHI
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常務委員会は評議員会にはかり次の事を決定した。

朝日賞に会員松本達郎君の研究“日本及び北アメリカ白堊紀菊石の研究”を推薦することとした。

	開催地	開催日	講演申込締切日
1959年総会，年会	東北大学	1960年1月16,17日	1959年12月20日

会員消息

会員加藤誠君は英国 British Museum (Natural History) に留学のため本年3月出発した。

会員半沢正四郎君は米国 Cornell University 其の他に招聘され渡米中であつたが本年8月帰国した。

会員奈須紀幸・新野弘両君は米国 New York で開かれた第1回国際海洋学会に出席し本年9月帰国した。

会員三木茂君は Canada, Montreal で開かれた第9回国際植物学会に出席し本年9月米国経由帰国した。

会員新野弘君は Ecuador の Galapagos 島探検のため本年10月出発した。

NEWS

◎ 1958年 Heerlen で開催された第4回国際石炭紀層位学地質学会議の石炭紀層位学に関する委員会で Carboniferous は system であり，それを分割してもよいがその分割したものは subsystem として認めるべきでないと決定した。但しこれにはアメリカ合衆国及びカナダの代表より反対意見が出されている。

なお Upper 及び Lower Carboniferous を西欧では Dinantian 及び Silesian と呼ぶよう提案された。

◎ 第19回国際地理学会議及び国際地理学連合の総会は1960年8月6日より12日にわたり Sweden の Stockholm で開催される。第20回国際地質学会議 (Copenhagen) の出席者は地理学会議の見学旅行に参加することができる。

◎ 会員井尻正二君等が中心となって化石研究会が発足した。連絡先は資源科学研究所藤原隆代気付。

購読御希望の方は本会宛御申込下さい

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Regulations for Publication in Transactions and Proceedings of the Palaeontological Society of Japan

(1959, 12, 6)

1. Manuscripts considered for publication should have been read at the General Meeting or the Ordinary meeting of the Palaeontological Society of Japan.
2. Manuscripts shall be written in European language, they should be typed on one side of standard-size (22.5×27.5 cm) paper and double-spaced throughout. Biological names should be in italics and be underlined by the author.
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10. The author's official address should be given below his name, under the title.
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